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Thesis

THE PRINCIPLES UNDERLYING THE PRESENT GEOGRAPHICAL
DISTRIBUTION OF DOMESTIC MAMMALS

Submitted by

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(S.B. Boston University, 1927)

In partial fulfilment of requirements for
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CONTENTS

Chapter I	The Origin of Domestication	Page 1-10
	The Complexity of the Problem	1
	The First Domestic Animals	2
	Changes in Animals Under Domestication	4
	Unconscious Selection	6
	Regions with no Suitable Animals for Domestication	7
	Regions with only Unsatisfactory Animals	8
	Regions into which Satisfactory Animals Have Been Introduced	9
Chapter II	The Spread of Domestic Animals by Man	Page 11-33
	Highways and Barriers to Man and Animals	11
	Rivers as Highways and as Barriers	14
	Water as a Highway	15
	Mountains as a Barrier	16
	Swamps as a Barrier	17
	Effect of Vegetation on Distribution	17
	Effect of the Uses of Animals on Distribution	18
	For Transportation	19
	For Food Production	23
	For Supplying Clothing	26
	Distribution of Animals in Relation to Population	27
	Political Influences in Distribution	28
Chapter III	Factors Influencing Distribution of the Horse	34
	Early Distribution of the Horse	34

CONTENTS

Chapter I The Origin of Domestication

The Complexity of the Problem

The First Domestic Animals

Changes in Animals Under Domestication

Unconscious Selection

Regions with no Suitable Animals for Domestication

Regions with only Unsuitable Animals

Regions into which Suitable Animals

Have Been Introduced

Chapter II The Spread of Domestic Animals by Man

Highways and Barriers to Man and Animals

Rivers as Highways and as Barriers

Water as a Highway

Mountains as a Barrier

Swamps as a Barrier

Effect of Vegetation on Distribution

Effect of the Use of Animals on Distribution

For Transportation

For Food Production

For Supplying Clothing

Distribution of Animals in Relation to Population

Political Influences in Distribution

Chapter III Factors Influencing Distribution of the Horse

Early Distribution of the Horse

CONTENTS (continued)

Specialization of the Horse	35
Present Distribution of Horses	36
Arabian Horses	38
Distribution of the Ass	41
Distribution of the Mule	42
 Chapter IV Factors Influencing Distribution of Cattle	 46
General Distribution	46
Beef Cattle	48
Dairy Cattle	51
Cattle for Transportation	56
 Chapter V Factors Influencing Distribution of Sheep	 61
Historical Background	61
Some of the More Important Breeds of Sheep	64
Principles of Wool Production	67
Chief Sheep Raising Regions of the World	70
 Chapter VI Factors Influencing Distribution of:	
Goats	80
Reindeer	83
Elephant	87
Camel	91
Llama and Alpaca	92
Swine	95
Dog	100
Cat	104
Rabbit	106
Guinea Pig	107
 Summary	 108
 Bibliography	 112

32	Specialization of the horse
33	Present distribution of horses
34	Arctic horses
41	Distribution of the ass
42	Distribution of the mule
43	Chapter IV Factors influencing distribution of cattle
44	General distribution
45	West cattle
51	East cattle
52	Cattle for transportation
53	Chapter V Factors influencing distribution of sheep
54	General distribution
55	Some of the more important breeds of sheep
57	Production of wool production
70	Other sheep raising regions of the world
71	Chapter VI Factors influencing distribution of:
72	Goats
73	Antelope
74	Elephant
75	Camel
76	Llama and alpaca
77	Swine
78	Pig
79	Goat
80	Rabbit
81	Quail
82	Summary
83	Bibliography

LIST OF MAPS

World Map of Horses	Page 40
World Map of Mules and Asses	45
World Map of Cattle	59
World Map of Dairy Cows	60
World Map of Sheep	79
World Map of Goats	82
World Map of Camels, Elephants, and Reindeer	94
World Map of Swine	99

LIST OF MAPS

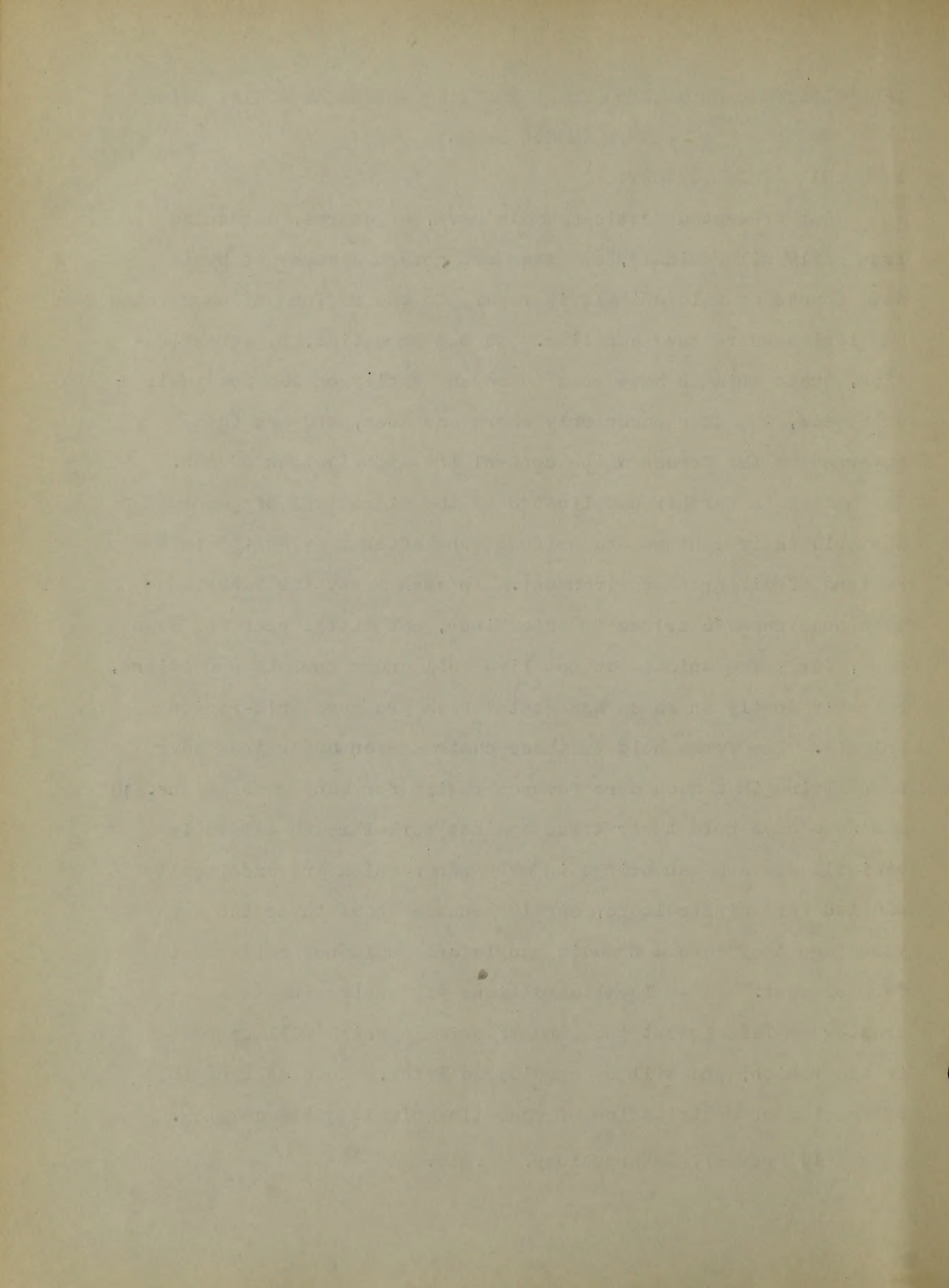
40	World Map of Horses
45	World Map of Horses and Asses
52	World Map of Cattle
60	World Map of Dairy Cows
72	World Map of Sheep
82	World Map of Goats
	World Map of Elephants, Rhinoceroses,
94	and Reindeer
98	World Map of Swine

THE PRINCIPLES UNDERLYING THE PRESENT GEOGRAPHICAL DISTRIBUTION OF DOMESTIC MAMMALS

I ORIGIN OF DOMESTICATION

Our present domestic mammals have, of course, descended from early wild animals, and thus are governed somewhat by the same forces as wild animals in regard to the regions of occurrence and limits where they can live. At the same time, by domestication, these animals have come to depend wholly on man for their existence, and thus occur only where man does, and are thus governed by the forces which control the distribution of man. The matter is further complicated by the migrations of people who hold their customs and beliefs long after they settle in regions of different environment. In such a way the Turks, who were once nomadic tribes in Asia Minor, eat little beef and less pork, for these animals do not live well under nomadic conditions, but rely mostly on sheep and goats which are good arid-region animals. The Turks hold to these customs even after they have been living in a much more favored region for many generations. (1) The Jews have held their taboo against pork through all their vicissitudes and wanderings in many lands which are excellently adapted for swine culture, merely because about three thousand years ago they were a nomadic people and could not raise that form of meat. Other local conditions also determine to a greater or less extent the kind of animals which will be raised in the region, and will be considered later. Thus we find the principles of distribution of domestic animals quite complex.

(1) Kroeber, Anthropology. P.414.



The First Domestic Animals

Our knowledge of the first domestication of animals is, unfortunately, limited to very scanty findings in the graves of some of the prehistoric peoples, but animals may have been domesticated for a long time before. The best we can do in supplying the details of the account, is to be guided by fragmentary evidences and by some knowledge of the conditions and methods used by primitive peoples at the present time.

The Dog

The first animal to be domesticated was very probably the dog.(2) Paleolithic men were hunters, and hunted dogs, among other animals, for food. Species of dogs are found in most parts of the world, so the story of their domestication might apply to many regions. A female dog may have been killed, leaving a litter of helpless pups which were taken home for pets for the children. We know that the Australian aborigines, who have never domesticated animals, do have pets. They catch rats, opossums, wallabies, bandicoots, frogs or young birds for playthings. They tie them up to prevent their escape, but do not feed them, so the animals soon starve to death. Some of the animals do learn to be self-supporting and live around the camp.(3) In this way one or two of these puppies may have survived by eating camp refuse, and when grown, followed his master out hunting. It is rather fascinating to one who loves dogs, to picture this early hunter finding for the first time this friend and protector, when a wounded animal, attacking

(2) Norman Ault, Life in Ancient Britain. P.60.

(3) Encyclopedia Britanica, Domestication of Animals.

The knowledge of the first domestication of animals is, unfortunately, limited to very scanty findings in the graves of some of the prehistoric peoples, but animals may have been domesticated for a long time before. The best we can do is to study the details of the account, as far as it is based on literary evidence and by some knowledge of the conditions and methods used by primitive peoples at the present time.

The Dog

The first animal to be domesticated was very probably the dog. (1) Paleolithic man was hunters, and hunted dogs, among other animals, for food. Specimens of dogs are found in some parts of the world, as the story of their domestication might easily be traced. A female dog may have been killed, leaving a litter of helpless pups which were taken home and kept for the mother. We know that the domestication of animals has never been interrupted, and that, though some of the most important, well-known, domesticated dogs of today were first brought to them up to prevent their escape, but the dog has been the animal most closely associated with man. The animal has been to be self-sufficient and live around the camp. (2) In this way one or two of these puppies may have been kept by their camp, and then given, perhaps, to another and so on. It is rather interesting to note that the first time this animal was mentioned, when a certain animal, (3) (4) (5) (6) (7) (8) (9) (10) (11) (12) (13) (14) (15) (16) (17) (18) (19) (20) (21) (22) (23) (24) (25) (26) (27) (28) (29) (30) (31) (32) (33) (34) (35) (36) (37) (38) (39) (40) (41) (42) (43) (44) (45) (46) (47) (48) (49) (50) (51) (52) (53) (54) (55) (56) (57) (58) (59) (60) (61) (62) (63) (64) (65) (66) (67) (68) (69) (70) (71) (72) (73) (74) (75) (76) (77) (78) (79) (80) (81) (82) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92) (93) (94) (95) (96) (97) (98) (99) (100) (101) (102) (103) (104) (105) (106) (107) (108) (109) (110) (111) (112) (113) (114) (115) (116) (117) (118) (119) (120) (121) (122) (123) (124) (125) (126) (127) (128) (129) (130) (131) (132) (133) (134) (135) (136) (137) (138) (139) (140) (141) (142) (143) (144) (145) (146) (147) (148) (149) (150) (151) (152) (153) (154) (155) (156) (157) (158) (159) (160) (161) (162) (163) (164) (165) (166) (167) (168) (169) 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the crudely armed master, was unexpectedly dragged down by a ferocious canine, whose instinct to protect has always been a notable trait. When the dog showed his ability to track and overtake game, and finally to warn his master of the approach of marauders, his position as man's comrade was made sure for all times.

Cattle, horses, swine, etc.

Most of the domestic animals seem to have originated in Western Asia (4), and to have been imported into Europe with the migrating tribes. They were likely derived from Asiatic species. The Asiatic cow (*Bos nomadicus*) was domesticated about 8000B.C.; and there were flocks of goats and sheep, as well as camels, in Asia about 6000B.C. Wild horses lived in both Asia and Europe, but it is not known just when they were domesticated. The bones of two varieties of pigs, as well as of some other animals, have been found in the pile dwellings of Neolithic Europe. These swine may have been domesticated wild boars (*Sus scrofa*), but seem to have been crossed with the Turbary pig (*Sus palustris*), which is an Asiatic form. With the early Neolithic time, man began to live a more settled life, to cultivate the soil, and to raise animals. During this period he made great advances, but the discovery of domesticating animals was of inestimable value in preventing famines, and in aiding in the other advances, such as the use of animals for draught purposes. The raising of sheep easily led to weaving, in time, and inventiveness in one line led to advance in others. Such advances were pitifully slow, however, for there is severe social

(4) H.F.Cleland, Our Prehistoric Ancestors.1927. P.336.

pressure against advance and innovation, in all primitive communities.

Changes from Domestication

Domestication and selective breeding unquestionably changed certain of the animals very much. Forms unable to adapt themselves to man's purposes and care were dropped or died out, and the useful varieties came to depend more and more on man for protection and food. In time the untamed individuals became extinct, or the domestic forms diverged so far from them that they appeared as distinct varieties or species. This is especially true in the cases of sheep, goats, cattle and some of the dogs, for none of the present wild members of these families are closely enough related to them to be their ancestors. None of the wild sheep, for example, have wool, but are covered with hair. The development of wool must have come either from some breed of sheep now extinct in the natural state, or as a result of the more favorable conditions of domestication. Furthermore, in the wild state sheep are very wary, agile, and cunning, while all the domestic^{ones} are quite the reverse. Such changes could only occur after many years of domestication, subject to man's conscious or unconscious adaptations to his needs or fancies. So also we find the various breeds of sheep fitted for different conditions, some doing better on cultivated land, some in mountain pastures, some in arid regions, and others in relatively humid localities.(5) In a similar way with the cattle, all the modern forms seem to come from some common stock which is not

(5) Charles Darwin, Origin of the Species. Chapt.I.

in existence at the present time. The different varieties or breeds of ordinary cattle (*Bos primogenius*), of Europe, do not greatly resemble such Asiatic species as the Zebu (*Bos indicus*), Gayal (*Bos frontalis*), Yak (*Bos grunniens*), or Water Buffalo (*Bos bubulus*); yet all belong to the same genus and are internally much alike. (6). Such changes are no greater than should be expected after many centuries of selective breeding under greatly dissimilar physical conditions.

Such changes occur very slowly in nature, for if an individual varies somewhat, it is likely to mate with a normal animal, and the effect be to dilute and remove the variation. Under domestication such changes may occur with surprising rapidity. (7) In the first place the domestic animals kept by savages have to struggle for their food at some seasons of the year, and so certain individuals of slightly different constitutions or structure, would often be more successful in surviving in one country than in another, and two sub-breeds might be formed, one in one locality, the other in a slightly different one. Then, further, under the conditions in which they were living, certain individuals in either of the sub-breeds would be more productive or better adapted and would come to give some of their characteristics to the herd, partly because of "survival of the fittest", but more because of what Darwin calls "unconscious selection." That is, everyone tries to possess and breed from the best individual animals. (8). No attempt is made to alter

(6) H.F. Cleland, "Our Prehistoric Ancestors." P. 107.

(7) Charles Darwin. "Origin of Species." p. 23.

(8) Ibid. P. 25.

in accordance with the present law. The difficulty is that
there is no statutory authority for the proposed
amendment. It is true that the law is not
perfectly clear, but it is not clear enough
to justify the proposed amendment. The law
is clear enough to show that the proposed
amendment is not in accordance with the
present law.

The proposed amendment is very clearly in
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the breed, but when this process is continued through many centuries any breed would become modified. If the region were one of broad areas and few barriers, the change would be slight, for the many herds would tend to mix and weaken the effect of any divergence of a few animals. In regions of smaller geographic areas with barriers separating, the modification would be much greater. So we find the animal life of isolated regions differing in a more or less degree from that of other regions, depending on the degree of isolation, the length of time isolated and the amount of difference in conditions. Horses which have been introduced by man into less favorable isolated regions have become adapted in this way, as the broncho of the prairies, the small sure-footed horses of the mountainous parts of the West Indies, and the tiny rugged horses of the Shetland Islands.

This "unconscious selection" is not entirely without consciousness on the part of the breeders, for even primitive peoples held a high regard for good domestic animals, as Livingstone found among the negroes of Central Africa. In early historic times there was a decided effort to improve domestic animals, and the Egyptians have left writings on the methods of so doing. The Romans had definite ideas of what constituted good animals and were anxious to get the best. They had rules for improving the breeds, and imported horses for breeding.(9). If we admit, as the evidence indicates, that these selective processes began in the very early stages of

(9). De Rerum Rusticarum, Varro, Book II.

domestication, it is easy to see how the present domestic animals might differ very widely from the related wild forms, as well as from domestic varieties in other localities where conditions and demands were different.

When the natives of any region reach that indefinite stage of development when they turn from the hunting form of living to the pastoral, they begin to domesticate animals. To accomplish this there must be such animals present as fulfill their requirements. If no satisfactory animals are indigenous there are three possibilities; either the people do entirely without domestic animals, domesticate unsatisfactory animals, or introduce more satisfactory forms from other regions.

Regions with no suitable animals for domestication

There are some regions so isolated as to have practically no native animals which could be domesticated, and with such barriers as to prevent the introduction of animals from more favored regions. Australia is the greatest development of such a condition, which is also found in some islands and mountain provinces. Australia has been isolated for such a very long time that the animals found there are quite distinct and specialized; in fact many of them are so low in the scale of development as to seem to be relics of a past age. There are no ungulates, and none of the other animals are adaptable for domestication. One can picture the difficulties of using the largest of these animals, the kangaroo, for either draft or pack purposes. Thus the Australian aborigines did without

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To summarize this there must be good animals present as well as
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domestic animals until white man came with other forms.

Regions with no satisfactory animals

Regions without satisfactory animals to domesticate, and with such physical conditions as would prevent their introduction, either because of barriers, ignorance of the people or conditions in which the more desirable animals could not live, often utilize such animals as they have. So we find the reindeer and dogs of the Arctic, the llamas of Peru, the elephant of India, and the yak of Tibet. None compare with the horse in efficiency, but all live under conditions which horses could not endure, and serve man's purposes remarkably well, considering. Man chooses that form of animal which most efficiently supplies his needs under given conditions. For transportation under favorable conditions this animal would be the horse, but where the horse cannot well live, those animals which seem next best and are available are used.

On the other hand, the presence of satisfactory animals to domesticate does not always cause a people to domesticate them (10), for the Chuckee tribe of Northeastern Siberia domesticated the reindeer, the Eskimo only hunts it. There must also be conditions making the domestication favorable, or such as to induce the people to domesticate animals, because of competition or imitation. The African elephant was never

(10) Alfred M. Tozzer, Social Origins and Social Continuities, Page 46.

tamed or domesticated by the natives, for they could easily supply their wants by hoe culture; while the Indian elephant has been used for centuries for many purposes by the peoples of southern Asia. Doubtless this early adoption of these massive, but inefficient animals was because the people were familiar with forms especially well suited to man's use in other environments, and their desire for some substitute led to pressing into service this form not so well suited. (11).

Regions into which satisfactory animals have been introduced

Very few people, so primitive as to be just reaching the stage of domesticating animals would have sufficient contacts to introduce animals from other regions. Sometimes such people might have been delayed in their development by lack of animals to domesticate, and have improved rapidly when such animals were supplied from one source or another. Such were the American Indians of the plains. At the time of the discovery of America by Columbus, the dog was the only animal domesticated by them. Of the other animals in North America, none seem to have been practical for domestication. The bison served the prairie Indians almost as a domestic animal, for they used it for food, clothing, shelter and fuel. The moose was used in the East, and still is used by the Indians of Quebec and Ontario in a similar way. Under the conditions of life of these people the moose and bison

(11) Vidal de la Blache, Principles of Human Geography.

were less care in the wild state than they would have been had they been domesticated.

The horse had become extinct in America, but soon after the beginning of the seventeenth century, (12), the plains Indians rapidly became mounted. Today they are nearly always thought of as equestrian folk. Yet all the Indians of North America had worked out their civilization without other domestic animals than the dog. There are conflicting viewpoints as to the reasons for this lack; some think that the Indians were backward and, if they had had the capacity, could have domesticated some of the native ungulates. (13) Others point out that none of these North American animals have ever been successfully domesticated even by white man, and that the Indians had plenty of ability, for the South American Indians domesticated the llama and alpaca, and the North American Indians readily adopted the horse, after it was introduced by the Spanish. (14)

Practically all the populous parts of the world have secured their successful domestic animals from outside regions. Much of this diffusion came about in quite recent times, since the advent of navigation, and the exploration and colonization of the world by Europeans. The very animals which these Europeans carried with them, however, were in turn, for the most part, introduced into Europe from other regions.

(12) A.M. Tozzer, Social Origins and Social Continuities. Page 21.

(13) Vidal de la Blache, Principles of Human Geography, Page 360.

(14) Charles A. Ellwood, Cultural Evolution. Page 126.

II THE SPREAD OF DOMESTIC ANIMALS BY MAN

Highways and barriers to man and animals

As far as the anthropologists have been able to determine, man originated somewhere in Central Asia, and spread from there to the rest of the world. There is, however, no adequate proof of this theory. Strangely enough, we also find that nearly all of the animals which have been widely domesticated the world over seem to have originated in Central Asia. This has quite logically suggested that such profusion of life could be caused only by physical conditions which were more favorable than are found in that region today. However that may be, we do know that since animal life appeared, many changes in land form have taken place, and that the animals have also been greatly altered. Seemingly as a result of changed environment, many animals have been unable to adjust themselves and have become extinct; others have adapted themselves and have developed into very different forms. There is evidence that many land areas which are now isolated were once connected by land. By means of such land bridges the original dispersal of animal forms seems to have taken place, with many related forms occurring in widely different regions. After some geological changes and the formation of barriers, the animal life thus isolated tended to develop variations; some died out as already mentioned, others became modified, and the region came to have a distinctive fauna. The animals of those regions which were separated earliest represent the greatest variation, while those which were more recently isolated show much less divergence from the fauna of the parent region.

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When man first migrated to the ends of the earth from his supposed Asiatic source, he would have been much too low in the scale of development to have had any domestic animals. His would have been a purely hunting subsistence, and he would have secured his food from whatever animal forms he found in the regions. As long as man lived thus he was closely dependent upon the ability of a region to supply wild life, and on the clemency of nature to maintain an even supply of this food through the seasons. He could not store large amounts of food, and an off season meant famine and death.

Such a hunter would tend to follow the best hunting, and to select those places that best kept him in food. If a shortage occurred in one region, he must either starve or move, and as the former has always been unpleasant, the latter was usually chosen, the more so because there would have been little impedimenta to move anyway. So we find primitive man migrating constantly through all the ages, although very slowly for the most part, until, in time, he has come to people almost the entire land area of the earth.

Since the Old Stone Age, we find evidences of migrations, which have recurred from time to time. These have been either as marauding hordes of conquest, like the Huns of Attila and the Mongols under Genghis Khan and Batu Khan; or as the wanderings of hunting tribes like the migrations of the American Indians and of the Siberian hunting tribes; or as aimless wandering in search of better lands, like the Celtic tribes in Europe, and the outflow of Mongoloid tribes from

There was a faint glimmer of light in the distance
and the sound of the sea was heard. The water was calm
and the sky was clear. The sun was shining brightly
and the air was warm. The birds were singing
and the flowers were blooming. The children were playing
and the old people were sitting on the benches.
The world was full of life and joy. The sun was
shining brightly and the air was warm. The birds
were singing and the flowers were blooming. The children
were playing and the old people were sitting on the
benches. The world was full of life and joy.

Central Asia. Often the motivating cause was overpopulation, but in more recent times we have found a similar movement resulting from colonial policy, imperialism, or desire for commercial advantage. The desire for power has been another spur which has done much to scatter man and start waves of migration.

The earliest dispersal must have occurred long before the domestication of animals, for the migrating peoples seem to have taken no animals with them to enrich the natural fauna of the region into which they went. In these more or less isolated areas the people developed a culture determined largely by their environment. Where satisfactory animals were available and desirable, they often domesticated them; where no such satisfactory animals were present, or where their domestication was impractical, they continued to live by hunting, or supplemented their hunting by "hoe-culture". They continued thus until some wave of expansion reached them and their isolation was broken by the introduction of foreign methods. In some cases their isolation was so complete that no outside influence was felt until within the last century. Even at the present time we find many of the aborigines in remote parts of Australia, the East Indies, and Central Africa still living as they probably did a thousand years ago, untouched by the advance of the outside world.

The broad, open, level land areas have always been an aid and an encouragement to man's migration. The lack of barriers in the region, and the need of constant moving to find food, accustom people dwelling there to travel, and

lead eventually to a strong development of the "Wanderlust".(1) Thus primitive peoples start moving for very slight provocation. As they have no way of knowing whither their journey leads them, unless they have been over the region before, they keep going blindly forward, by the path of least resistance, from sheer force of momentum. Most commonly these migrations have been slow wanderings, but occasionally they assume the appearance of an exodus. Because of the lack of a visible goal, their route would be crooked, turning away from the barriers, following the least rugged pathway, and the best source of food. Offshoots of the main party were left behind or turned into some valley which especially pleased their fancy.

Rivers as a highway and as a barrier

River valleys were often followed. The Danube has been a well-known highway for wave after wave of migration. The Rhone has been the highway into France, the Humber and Trent into England, and the Amoor into Siberia. Any natural clearings that existed helped the movement, while forests have always hindered. When a people had progressed sufficiently to use the natural waterways as highways, their manner of transportation, and their routes changed at once. The rivers, which had formerly been barriers, turned into their easiest means of travel. At the same time, however, any larger domestic animals which they might have had, especially

(1) E.C.Semple, Influence of Geographic Environment.

that eventually as a result of the development of the
the political parties that have for very long been
as they have no way of knowing whether their journey leads
them, which have been over the region before, they have
either blindly forward, by the path of least resistance, from
some form of domination. Most commonly these signals have
been also misleading, but occasionally they have the appear-
ance of the genuine. Because of the lack of a visible goal,
these people seem to proceed, turning away from the barriers,
following the least rugged pathway, and the best source of
food. Of course of the path they have felt behind or turned
into some valley which suggests a pleasant future.

History as a history and as a barrier
River valleys were often followed. The lands have been
a well-known highway for many after years of migration. The
The road has been the highway into France, the highway into
Great into England, and the road into Siberia. Any highway
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easily to use the natural pathways as highways, their manner
of transportation, and their routes changed at once. The
river, which had formerly been barriers, turned into their
as a source of supply. At the same time, however, the
largest domestic animals which they might have had, especially

if used for transportation, became useless, for horses, cattle, sheep and goats are not transported easily by canoe or dugout. If it was only a case of crossing a stream, these animals could swim, but for longer trips they were out of the question. The Celts crossing to Britain in their coracles could not have taken any large animals with them, even had they been dependent on them; nor could the Polynesians take any with them in their outriggers while migrating to the Pacific Islands.

Water as a Highway

Even after people became familiar with river and lake travel, the ocean remained a barrier. But when it was finally conquered, it also became a great connecting highway, the greatest of all, in fact. Yet until the development of larger ships, water travel precluded the carrying of the large domestic animals. Thus long after water ceased to be a barrier to man himself, it remained a barrier to the most useful of man's domesticated animals, the ungulates. Until the arrival of white men, there were none of these larger animals in the islands of the Pacific, although man had succeeded in crossing the stretches^t of water in his dugouts and outriggers. After the advent of large boats and further knowledge of navigation, man's carrying power as well as his travelling power increased, and those animals which are most profitable and useful have been introduced into nearly all regions where it is possible for them to live.

It was the transportation, however, that was the
main factor and not the transportation itself. It was
it was only a case of changing a horse, from a
single horse, and the larger ship was out of the question.
The boats crossing to Britain in their capacity could not
have been any larger than the ones that had been
designed on them, not could the Belgians take any
more in their capacity with respect to the traffic between.

Even other people became familiar with river and lake
travel, the coast remained a mystery. For when it was finally
conquered, it was because a great conquering ship, the
greatest of all, the ship. For until the development of
larger ships, water travel precluded the carrying of the
large economic animals. Thus long after steam had been
applied to land travel, it remained a mystery in the water.
Until the arrival of the steamship, the highway. Until
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regions where it is possible for them to live.

Mountains as a Barrier

Mountainous regions offer a barrier to tribes of the plains, for their horses, cattle or other animals cannot cross the rugged land. If the people are to cross they must either desert their flocks or find some route possible for them to follow. The more rugged the region, the more complete the barrier. These inhospitable localities are avoided as much as possible, and only inhabited when invaders force the older population out of the more favorable places to take refuge in the hills. Here the fugitives were not likely to be followed, so they remained to live as best they could. Here they could develop a new culture to suit their needs, with little influence from others. Transportation was so difficult that communities were isolated, and became practically islands, remote from the rest of the world. Other migrations seldom reached them, for the migrating peoples followed easier routes, and the mountaineers were inclined to be warlike, and hostile to interference. The Scotch, Irish, Welsh, Swiss, Montenegrans, Tibetans, Incas, Aztecs and Pueblos are all examples of such refugees in mountain regions. In these isolated areas, the animals raised are found to be of different varieties from those kept in the neighboring plains regions, a distinction caused, no doubt, because of the different environment and requirements of the animals in the mountains, where the prime necessity is to survive the rigor of the climate. Such conditions continued through many generations of unconscious

selection might well develop a separate variety. These would be offshoots from the principal line of distribution, for the main movement would pass around these mountain areas, or be turned back by them.

Swamps as a Barrier

Swamps and marshes are even a more complete barrier than mountains, for they are usually impassible to man and beast, malaria infested, subject to floods, and produce bulky vegetation with little nourishment. Swamps have been used in the past as zones of refuge, as by some of the lake-dwellers of the Neolithic times, and by the Saxons at the time of the Norman invasion of England. They are so non-productive and undesirable, however, that for ordinary conditions they are out of the question as dwelling places.

Vegetation

Where man takes domestic animals he must be able to feed them. Furthermore he must be able to provide them with vegetation which is abundant enough and nutritious enough for them to thrive on. In this way the soil and the vegetation act as a further limiting influence on man's distribution of his animals. Vegetation is affected by rainfall, temperature, altitude, latitude, soil and distribution of plant life in the region. Each of these will be considered to some extent under the zones of distribution.

Uses of animals

As already suggested, man's first use for animals was as a reserve for his food supply, a means of supplementing hunting and thus guarding against famine. Later, domestic animals were used for transportation, clothing and the sources of other raw materials than clothing, for protection, and finally for hunting, scavenging, and fertilizer. (2) The uses to which these animals are put are determined by man's needs under the conditions. When an animal is raised for a special use, it would tend to become specialized along the lines most desired and would supply the other uses in only a secondary way. A dairy cow is specialized in the production of milk, and a merino sheep in the production of wool; while both can be used to supply meat, it would be of inferior quality to the flesh of the corresponding animals which were developed especially for the production of meat. The horses of the Bedouins are used for riding in their attacks, and must be swift and enduring; the Percheron horse is used for heavy draft work, and is a thick-set, strong animal, capable of pulling the great loads necessary in a highly developed agricultural and industrial country. Thus under certain conditions, man finds that he needs his animals for certain uses, so he selects those animals which best fulfill his requirements, and the other animals fail to be distributed in these regions.

(2) Huntington & Williams, Business Geography.

It is already suggested that the first use for animals was

as a resource for the food supply, a source of subsistence

which was then further developed, later, towards

animals were used for transportation, clothing and for sources

of other raw materials such as hides, for protection, and

for other purposes, such as for the production of

useful products which animals are and are destined to be

used under the conditions. When an animal is raised for a

special use, it is raised to become specialized along the

lines that demand and which differ from other uses in only

a secondary way. A better use is specialized in the production

of milk, and a further step is the production of eggs, while

both can be used as meat, it would be of interest

to study the effect of the corresponding animals which are

raised and especially for the production of milk. The purpose

of the breeding is used for giving to their offspring, and

that the best and best of the breeding power is used for

every other use, and in a special way, where animals, especially

of breeding the best is necessary in a highly specialized

breeding, as in industrial countries. Thus when animals

are bred, and found that the animals are raised for certain

uses, so the subjects of the animals are not raised for

reproduction, and the other animals fall to be specialized

in these regions.

Use of Animals for Transportation as a Factor in their Distribution

The use of animals for transportation and draft purposes has been very important in man's progress and distribution. Without animals to carry or pull loads, many of the migrations would have been much slower, if not wholly impossible, for all the burdens would otherwise have been carried by human beings. Many places would be uninhabited at present because of their remoteness or the impossibility of man's securing food. The present distribution and density of population would certainly have been impossible without the use of animals for transportation, for man alone could never have moved the necessary amounts of goods to make possible our present-day consolidation of population, and industrial development. Agriculture would have had to continue as hoe-culture, which method is almost impossible in the temperate regions where sod quickly covers unplowed fields. After man learned to use animals for plowing, these more stimulating temperate regions became the areas of great production and progress. In order to use draft animals more successfully, the wheel was developed, and from this came modern machinery.

At times it seems as though horses and similar draft animals were doomed to be replaced by motor transportation and tractors. This is really happening in a few places, but for the great majority of the world, animals will continue

use of animals for transportation as a factor in their development.
The use of animals for transportation has been
increased and been very important in their development and dis-
tribution. Without animals to carry or pull loads, many
of the primitive people would have been much poorer, it is easily
impossible for all the primitive people to have been
carried by pack animals. Many places would be inaccessible
without because of their remoteness or the impossibility of
man's carrying food. The great distribution and develop-
ment of primitive people would have been impossible without
the use of animals for transportation. For man alone could
never have moved the necessary amounts of goods to have
developed his present-day civilization or population. The
impossible development. Primitive people have had to con-
tinue in non-civilized which would be almost impossible in the
temperate regions where and which could have followed them.
After man learned to use animals for transport, these were
extensive and primitive people began the work of great
production and progress. In order to use their animals more
effectively, the wheel was developed, and time was saved
modern machinery.
At times it seems as though horses and oxen have
animals were needed to be replaced by motor transportation
and therefore. This is really something in the future, and
for the great majority of the world, animals will continue

as the source of power or the means of transportation. In fact the United States is about the only country in which motor power has caused any great diminution in the number of horses. Even in many parts of the United States, however, tractors are impractical, and automobiles of no use during certain seasons. It is in these unfavorable regions that horses are most necessary. It is a general rule that under given conditions the most effective form of power or transportation for those conditions will be used. Thus we find on the broad fertile plains of the Middle West that motor power is in general use, and the horses that are kept are big, strong, well-developed animals. In the less productive areas of the temperate zone, these high-grade horses are not found; but instead, smaller horses, often weaker, less-developed or worn-out beasts are pressed into service. Oxen or mules are often used as substitutes, for while they are less efficient than a high-grade horse, they can subsist on the rougher fodder and poorer care which animals in such localities must endure. The fields are often broken up by the irregularity of the relief, and are so small that tractors or large horses are unable to successfully work the ground. Returns on such land are meager, and the initial outlay necessary to purchase expensive tools or horses cannot be met by the impoverished inhabitants, even should such an expenditure be justified by the other conditions.

in the light of some of the more recent observations
that the United States is about the only country in which
the most recent has been very great attention is the matter
of human. There is some basis of the United States, however,
to show the importance, and importance of the use of
certain reasons. It is in these various regions that
there are some necessity. It is a general rule that most
often conditions the most effective form of power is in the
position for the conditions will be seen. There is the
of the world's history of the United States that most
power is in human, and the power that is left to
it, often, will develop as animals. In the late prehistoric
times of the temperate zone, these high-grade animals, as the
found, but instead, earlier stages, of the water, later-
stages of water-birds and stages into water. These
at times and often used as water-birds, but this time are
in a different form a high-grade animal, they can water.
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conditions must water. The birds are often broken up by
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In rugged, mountainous regions small scrubby horses are used, which are unable to carry very heavy loads, but are very sure-footed and used in ascending and descending steep trails. If it is too rough for even these horses, or the forage so scanty as to not support them, donkeys or other local animals are used, such as the llama, alpaca, or yak. These would be used as pack animals where roads are impossible and even paths or trails are rough. The amount of load they could carry would be much less than that which a good horse could bear, and the distance which these animals could travel in a day, even with the lesser load and on reasonably good going, would not be as much as the horse would be capable of. Yet these relatively inefficient animals would be the most effective form under the conditions in which they would be used. The contrast reaches its climax under the least favorable conditions of all, namely, the tundras, the jungles and rain forests. In neither of these extremes can horses thrive, and so the most effective substitute is employed. In the Arctic, dogs and reindeer are used, both of which are better adapted for pulling than for packing, and the long duration of the snow-cover makes sledges drawn by them the logical means of travel. Neither of these animals would be able to compete with the horse under the best of conditions, but in the Far North they can be fed easily where a horse could not; the reindeer on the tundra moss, and the dog on meat or other concentrated and easily carried food. In the

hot regions various species of cattle are used, forms which thrive under the necessary conditions. These animals would not well compete with the horse, and are usually very slow and often unable to work continuously for long hours. In the rain forest the elephant has been forced into service. While this huge animal is very strong, it is incapable of working more than a few hours a day, and thus its usefulness is greatly reduced.

The reason the horse is so much better than the other animal forms for transportation and draft purposes is that it seems to have about all the features that are desirable for these uses. (3) It is intelligent, sufficiently strong, can maintain good speed, day after day, and has a comfortable gait. It can pull as well as carry, can be fed easily under many conditions, and the young can be brought to maturity without too great expense.

For intelligence, the dog, horse, donkey and elephant rank especially high; (4) cattle, reindeer and camels are moderately intelligent; but llamas, sheep, goats and pigs are distinctly low in this respect. In the matter of size and strength it is necessary to have an animal which is large enough to carry a man easily, yet not so large as to be extravagant to feed for this purpose. The horse and cattle

(3) Huntington & Williams, Business Geography. P.187,188.

(4) Ibid, Page 187.

are about right in size and strength; the donkey, llama and reindeer are too small to carry a man for long distances; while the elephant and camel are so large that they can easily carry two or more men, and are thus expensive for carrying only one man. The horse and camel are the best for maintaining fairly good speed day after day; while the cattle, donkeys, reindeer and elephants are not so speedy or lack endurance. Cattle and horses are the best for pulling, while the llama, camel and elephant lack the necessary hard hoofs for such work. So it is we find the high-grade horse is the most satisfactory animal. This is only true under certain most favorable, or optimum conditions. The more the conditions of a region differ from this optimum, the more the animals used for transportation will, in general, differ from the horse.

Distribution of Animals as Determined by Food Production

As already suggested, animals were probably first domesticated in order to have a food supply more available and dependable for man. From this early time on, domestic animals have provided a very important part of the human diet, and extreme hardship would now result among most peoples if they were required to do entirely without the animal foods -- meat, milk, and eggs. With the exception of a comparatively few tribes who are so primitive as to have no domestic animals, and who supply these needs by hunting, some form of food from domestic animals is used by people the world over. The choice

of animals raised depends on physical environment, animal forms available, past history of the people, religious beliefs, and degree of culture.

Physical environment definitely precludes certain animals from living under some conditions. Sheep and goats cannot be raised successfully in the hot, moist regions, while the water buffalo cannot live elsewhere. Swine are naturally forest animals and are kept only where there is sufficient adequate food. It would be impossible to raise them in the arid pastoral regions, and so they are not found there. The conditions arising from the lack of available animal forms in a region have been considered on page 7, and the result of past history and religious beliefs on page 1.

The flesh of all the domesticated ungulates may be used for food, and moreover, is very good meat. Of the domesticated carnivora, none is ordinarily eaten, but the dog is reported to be excellent meat, and was the "fatted calf" of the American Indians, and was served only to favored and distinguished guests. The rabbit is the only domesticated rodent commonly eaten, except the Guinea pig, which was formerly a source of food, but is not used now for this purpose to any extent. Aside from the quality of the meat from the ungulates, the chief factor which limits their use for food is the length of the time it takes them to reach maturity. (5) For, though

(5) Huntington & Williams, Business Geography. Page 189.

of animal raised on physical environment, animal

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Aside from the quality of the meat from the vegetables, the

chief factor which limits food for food is the lack of

of the time it takes them to reach maturity. (a) For, though

horse flesh is said to be excellent eating, the four years required for the animal to reach maturity render it too slow and expensive, to be a common source of food. Cattle take about half as long to mature as horses, and thus become a more frequent source of meat. Sheep and goats take less time; pigs are still better, because they have several young in one litter, and also mature in a short time.

The fact that mammals supply milk, which is the most valuable single product in the world, (6) increases to an additional degree the value of those animals which are used for milk production. The chief mammals so used are cattle, goats, sheep and mares. Most parts of the world where any of these above-mentioned animals can be raised, use the milk from them, but certain conditions especially favor milk production. In general, where cities are located, the demand for milk is sufficient to cause most ordinary handicaps to be surmounted and the milk supplied. This would be only a local supply due to the unusual demand, and would not change the requirements for large-scale, successful milk production. The ideal climate for dairying is moderately cool temperature, with abundant and well distributed rainfall. The reason for this is to supply the high grade fodder which is necessary if the cows are to produce sufficient milk. The type localities for dairying are Denmark, Ireland and New Zealand.

(6) Huntington & Williams, Business Geography. Page 10.

Dairying will be considered at more length in the next chapter, under dairy cattle. In regions where cattle cannot be supported because of the aridity, ruggedness of the land, or lack of first grade fodder, sheep and goats are used for milk, since these animals can do well on scanty and rather coarse food, and can graze on slopes too steep for cattle, and bite off grass too short for cattle to eat. As milk producers, horses are of very secondary importance, for they are so used in only a few localities, by a few tribes who depend on horses for most of their needs.

The commercial use of animals for food has been a local proposition, depending on the availability of a market. As most of the foods spoiled quickly, the distance from the market could not be great, nor the length of time required to reach it be long. With rapid transportation, and modern methods of refrigeration, however, nearly any region which can be reached by boat or railroad, may now supply even perishable goods to distant markets. Such development has enabled remote lands to supply meat and dairy products to the great centers of population. Thousands of tons of meat are shipped to Europe from Australia every year, and New Zealand competes with American markets in supplying butter.

The Distribution of Animals in relation to Supplying Clothing Material.

Formerly distant lands could supply only unperishable products. Australia and Argentina were ideal grazing lands,

but could ship only wool, hides and tallow which would not deteriorate. The wool was most in demand and most profitable, so a great sheep-raising business developed, specialized on the basis of wool production. With a possibility of a market for the meat, the types of animals raised are changing to meet the double purpose of meat and wool. Wool, however, is a very important source of material for clothing, and there is never quite enough to meet the demands of the cooler regions. Sheep supply most of it, but the goat, alpaca, llama and camel are also of some importance. The raising of wool is a major industry of the world, and occupies an important amount of the land surface.

Distribution of Animals in Relation to Population

By the very definition, domestication presupposes the presence of man. Consequently we need to look for domestic animals only where we find man. The matter goes even further, however, for where we find the most men, there we find the most animals. Yet where there are many animals and many men, there are few animals per person. Conversely, where the population is sparse, the number of animals tends to be small, but the number of animals per person is large. This is, of course, because in the congested areas the many animals are needed for food and transportation chiefly, while in the sparsely settled country districts much of the occupation is pastoral, and many animals are raised to supply the more

thickly settled regions with food, clothing, raw materials, and animals for transportation. As comparatively few men can raise large numbers of animals, there will be many more animals per person than in the populous districts, yet the absolute number of animals kept in the open country will be smaller. This is a general statement, and as such will hold true in a general way, but will vary locally in some places because of such factors as climate, relief, prevalence of disease, location of markets, and degree of civilization. Thus we find that Central Europe, which is thickly populated, has a great many domestic animals per mile, yet very few per capita. (7) Central and Western Australia, which are very sparsely inhabited, are given over to sheep raising where it is not absolute desert; since one or two men can take care of several hundred sheep, and yet the sheep require a vast area to supply sufficient vegetation, there would be many animals per capita, but few per square mile.

Political Influences in Distribution

Political causes are important in the more recent distribution of domestic animals. Waves of conquest, colonization, and extension of empire, have caused the expanding nation to transplant its nationals, who would naturally take with them their customs, tools and animals as far as possible. There

(7) Huntington & Williams, Business Geography. Page 186.

would be a more or less definite policy on the part of the government to introduce all things which appear to embody its national culture, and to try to make the newly-acquired land as productive and thus as profitable as possible. While this policy can be traced more or less effectively from the earliest historic times, by many different nations, by far the best example found is in the present British Empire and the development of its colonies and colonial policy.

Colonial and Imperial Policy of England as an Influence in the Distribution of Animals

The colonies which were started in America had varying aims and objectives. The Virginia colonists, sent out for political expansion and to gain fortunes in the precious metals, were not interested in any phase of farming, until they eventually discovered that the real fortune was in the growing of tobacco. In order to gain big returns it was then necessary to clear land and cultivate on a more extensive scale than hoe-culture would permit-- therefore the importation of draft animals. Horses, mules and oxen supplied their needs.

The Massachusetts⁵ colonists came to this country with a different purpose and attitude -- that of making the new land a permanent home. They brought with them seeds of those plants with which they were familiar in England, and as soon as they could, they brought over those farm animals

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which they had raised at home. While in one sense the Massachusetts colonies were founded for religious rather than political reasons, at that time religion and politics were so inextricably interwoven that they were nearly synonymous. These colonies came about, furthermore, as a result of the definite policy of oppression by the government, for all who did not conform to the Anglican faith were prosecuted under the law. (8) The story of these colonies is so well known that it is not necessary to dwell on this point. By the seventeenth century the policy of the governmental officers began definitely to encourage emigration; there was a surplus population from enclosure and the breakdown of the guild system, and this seemed the easiest way to control the resulting vagabondage, and the dissatisfaction among the Puritans. The colonies in America pushed west; the French and Indian wars were fought in an effort to gain control of the Ohio and other valleys which France was threatening to occupy. British military success assured political control, which, in turn, meant protection and further encouragement of British people and ideas. Thus practically all the livestock in America was of English origin, until some time after the American Revolution, when improvement of breeds caused introduction of new strains. The chief exception to this would be the Texas cattle and the horses of the western

(8) C.E. Robinson, England. Page 387.

which they had refused to do. This is the same case-
the colonies were founded for religious reasons. At that time religion and politics were
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colonies has been to encourage education; there was a
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plains, which were the result of Spanish expansion.

The outcropping of the old Norman land-hunger and desire for larger possessions has led England as far as Australia and New Zealand in quest of empire. This expansion was further facilitated and made necessary by the island position of the home country. (9) In its limited area, protected to a large extent from other influences, yet in a position to profit by any progress on the continent, the English came to outgrow their island home and caused her territorial expansion to assume a solid, permanent character, (10) unknown to the flimsy trading stations which are found when the extension is only in the field of commerce. The sea which had protected them became their ready highway. Their fishing fleets trained men for the merchant and naval ventures which went all over the world. The merchants provided a market and created a demand for raw materials; the navy protected the merchant marine and the colonies; and the governmental policy recognized the value of trade and promoted commerce and naval programs. The possibility of a market caused large numbers of people to migrate to these new countries. Those products which could be most profitably raised and marketed under the local conditions were naturally chosen. In Australia this was wool; in New Zealand it was

(9) E.C.Semple, Influences of Geographic Environment.

Page 192.

(10) Ibid, Page 459.

wool and more recently dairy products; in Canada it was grain. Africa and India are not so well suited for the raising of English crops, for the climates are too dissimilar. In Africa attempts which were made to introduce European domestic animals were rewarded with some success. In India, however, conditions were different. There was already a large native population well established which could not easily be displaced. The Britons who went there were chiefly engaged in trade or in protecting the trade, and so had little interest in the type of animals used by the natives. The army did introduce and use horses, but chiefly for military purposes. More recently governmental policies have become broader, and more in sympathy with the native population, so that now improvement in method is coming about through the efforts of the British Department of Agriculture, which tries to teach the natives modern methods and to encourage the introduction of high-bred animals.(11).

One can hardly estimate the importance of the indirect effects of such an expansion policy of England, alone, in spreading European animals. The policy of the other nations has been affected by it and other peoples have profited by the distribution of such animals by the English and have adopted English methods. But England is not the only country which has had such an expansion policy. Each great conquer-

(11) World Almanac for 1930. Page 606.

and the more recently being introduced; in Chinese it was written.

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ing nation in history has exerted a similar influence. Egypt, Assyria, Babylonia, Greece, Rome, Portugal, Spain, Holland, France, Germany, Russia and the United States, have all carried to the new lands to which they have expanded, such of their animals as it was possible to raise there.

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FACTORS INFLUENCING THE DISTRIBUTION OF THE HORSE

Early Distribution of the Horse

The modern horse seems to have appeared first in Asia, and to have been domesticated by the peoples of Central Asia about seven or eight thousand years ago. These people used the horse first for food supply, the meat and mare's milk, and finally for transportation. (1) From Asia it has spread to all continents, and is now an absolute necessity for modern civilization. When it was adopted for transportation by primitive tribes it brought a new complexity of culture. The effect was very similar to the effect of the invention of the automobile on modern culture. Certain tribes became more nomadic, predatory and warlike, as the American Indians of the plains. It worked as a liberating influence to these primitive peoples when any of them acquired the horse, freeing them largely from the fetters of distance, making travel a possibility, migration easy, and conquest a success. The psychology of the man on horseback placed him in a definitely superior position to the enemy who was waiting for the attack, and was forced to look up and fight up. The foot soldier was at a disadvantage from the first, especially with the crude weapons of the early peoples. Horses revolutionized warfare, for it takes special preparation and equipment, as well as training to stand on the ground and

(1) Charles A. Ellwood, Cultural Evolution. Page 128.

face a group of charging horsemen. Later, when horses were hitched to chariots, they presented an even more formidable appearance to the attacked. The warlike spirit and attitude of the horse contributed to the early adoption of the animal for military purposes. (2) Military purposes and uses of horses have been the foremost factor in their widespread distribution. The early migrations from Asia were warlike in character, most of the peoples were mounted to some extent, and introduced the horse to the countries into which they went, putting the animal thereafter to purposes of peaceful transportation and agriculture.

The Specialization of the Horse.

The horse is a highly specialized animal. It is the product of the fertile plains, where it depended for safety on its fleetness and wariness. Its evolution can be traced with unusual completeness in North America, beginning with a fox-sized animal, and resulting in the different forms of the genus *Equus* towards the close of the Pliocene epoch. During the Pleistocene, horses were numerous in all continents except Australia. (3) They later became extinct in America, where they were finally introduced by man. Their evolution can be traced from the primitive form, and their specialization, habits, and adaptation to environment clearly illustrated. They have been specialized for travelling swiftly over relatively hard, level ground, and eating the best of the fodder that such

(2) Vidal de la Blache, Principles of Human Geography

Page 335

(3) Edward W. Berry, Paleontology, Page 311

face a group of charging horsemen. Later, when horses were hitched to chariots, they presented an even more formidable appearance to the attacker. The warlike spirit and attitude of the horse country-landed in the early history of the animal for military purposes. (2) Military purposes and uses of horses have been the foremost factor in their widespread distribution. The early migrations from Asia were marked in character, most of the peoples were mounted on horseback, and introduced the horse to the countries into which they went, putting the animal therefore to purposes of successful transportation and agriculture.

The Specialization of the Horse.

The horse is a highly specialized animal. It is the product of the fertile plains, where it depended for safety on its fleetness and swiftness. Its evolution can be traced with unusual completeness in North America, beginning with a 10-toothed animal, and resulting in the different forms of the genus *Equus* towards the close of the Pleistocene epoch. During the Pleistocene, horses were numerous in all continents except Australia. (3) They later became extinct in Australia, where they were finally introduced by man. Their evolution can be traced from the primitive form, and their specialization, habits, and adaptation to environment clearly illustrated. They have been specialized for traveling swiftly over relatively hard, level ground, and eating the best of the fodder that such

(2) Vidal de la Blache, *Principles of Human Geography*

regions produce. It requires well-watered areas, too dry for forests, or where the prairie condition has developed from other causes. There must also be food available the year through, for a deep snow cover which would bury the winter feed would prevent the horse from living wild in that region. Horses can, however, live nearly anywhere, if they are fed and housed by man. For this reason the present distribution of horses is very different from their original distribution. At present horses are where man finds it desirable to keep them, and not where the horses would live in the natural state.

The Present Distribution of Horses

The world map of horses, page 40, shows in green those regions where many horses are found. These regions are almost without exception identical with the areas of dense and progressive population. India and China, to be sure, have dense populations but are scarcely progressive, so that while horses are limited by climate, they are also limited by cultural development. Much of Africa and Asia is relatively low in culture; South America and Australia are not highly industrialized; and parts of North America, South America and Australia are not as densely populated as they might be, which would account for fewer horses being raised in these regions. Where the industrial development is most complete,

and the climate favorable, the most horses will be found.(4)
The amount of cultivated land also influences the number of horses, for these animals are used both for transportation and for plowing, harrowing, and the other processes of tilling the soil. Where natural feed is not adequate to support horses, and the returns on the work they did would not be enough to justify the purchase of oats or other feeds, horses are replaced by animals which can be more cheaply fed.

While horses can live nearly anywhere man does, if they are housed and fed, there are certain optimum conditions where they thrive best, and where they are most likely to be profitably raised. The regions colored green on the World Map of horses, are typical of such areas. Many of the areas colored yellow, and some of the regions uncolored, indicating that few or no horses are raised, have equally good climate and feed, but because of other conditions have few horses. For instance, the Southeastern part of the United States is a region of much cotton growing, with many acres under cultivation; it would compare favorably with the cultivation of some of the northern states, yet few horses are kept. This is because horses are replaced by mules which can thrive better under the climatic conditions and poorer feed of the South. In Africa other conditions cause the dearth of horses;

(4) Huntington & Williams, Business Geography. P.193,4.

for while the population is unprogressive, and little land is cultivated, there are also diseases, the most notable caused by the bite of the Tsetse fly, which preclude horses from living in much of the continent. The grass is coarse and not nutritious; there are also wild beasts, snakes and other discouragements. (5) In many of the regions where few horses are found, such a condition exists because of the sparsity of the population, for besides the total number of horses in a region, the relative number in proportion to the number of inhabitants is important. So in Massachusetts there are 114.3 persons for each horse, in Nevada there are only 1.8 persons for each horse. In Nevada, then, the horses would be much more important for the number of people, but as there are about fifty times as many people in Massachusetts as in Nevada, the total number of horses in the latter state would necessarily be few.

Arabian Horses

In Arabia another principle is illustrated in an interesting way. In any consideration of horses, those of Arabia are usually thought to be very important. In the time of Strabo the horse was ~~not~~ used in Arabia, but has been introduced since. It developed qualities from the necessarily good care it received, and met the demands of the Arabs for

(5) Huntington & Cushing, Principles of Human Geography.

enduring and swift transportation animals. "It shows the adaptability of the horse resulting from the variety of breeds, and this adaptability allows it to occupy the immense domain from the habitat of the reindeer to that of the elephant." (6) From Arabia the Crusaders imported horses for breeding purposes and ever since, this unquestionably superior breed has received a publicity and fame out of all proportion with the number of its individuals. The Arabian blood has been used to improve breeds all over the world, but in the limits of the Arabian country there are few horses. Only the richest of the Arabs can afford to own them, for there is little feed for horses in the region. Those that are kept are treated much as members of the family, fed on special fodder, cared for tenderly, and carefully bred to maintain the purity of the strain. The horse in Arabia is, in short, an animal out of its element, raised as a sort of luxury. Yet it is not entirely a luxury, for in the Arab's nomadic form of life, fighting, robbing and plundering have an accepted part. The arid lands are really the domain of the camel, but as this animal does not lend itself well to warfare, the horse is used for the fighting, and the camel kept for purposes of peace.

(6) Vidal de la Blache, Principles of Human Geography.

Page 356.

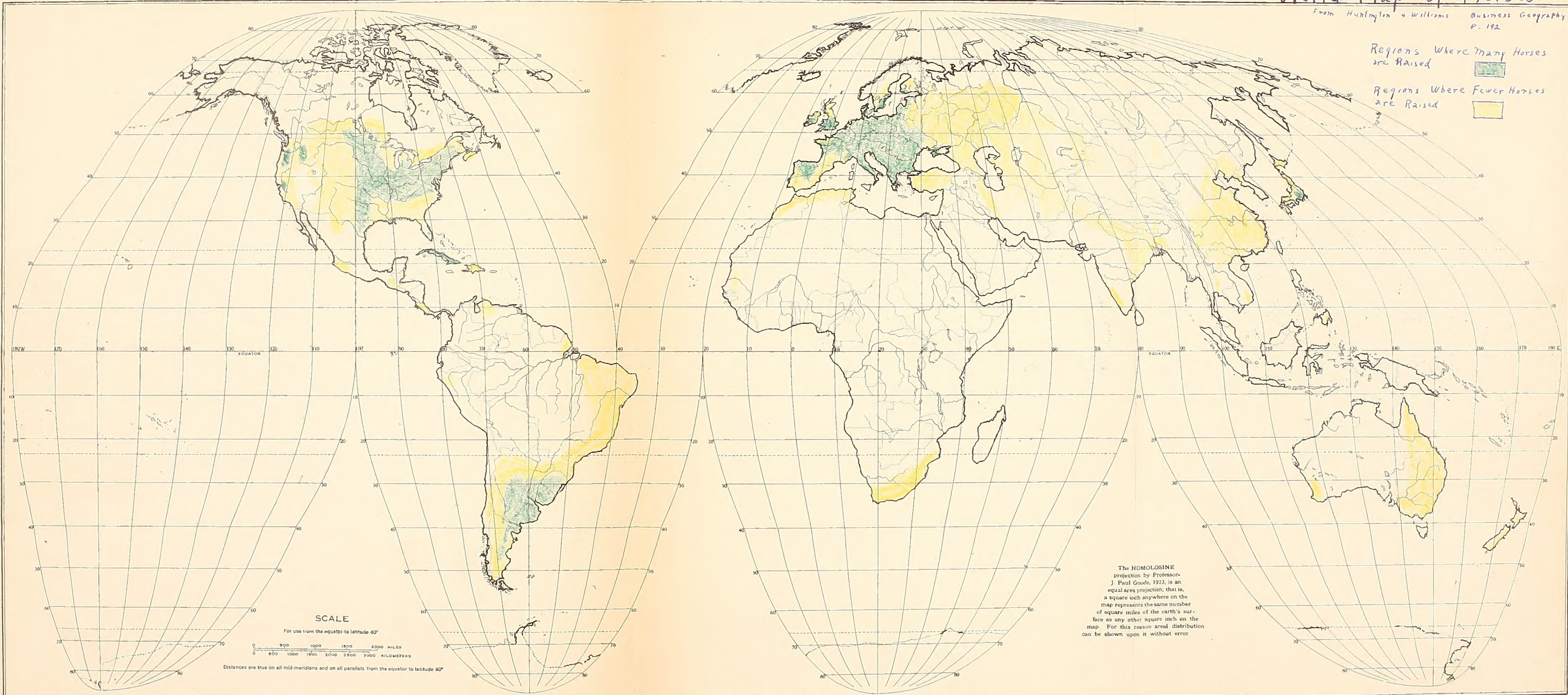
World Map of Horses.

From Huntington & Williams Business Geography P. 192

Regions Where Many Horses are Raised



Regions Where Fewer Horses are Raised



SCALE

For use from the equator to latitude 40°

0 500 1000 1500 2000 2500 3000 MILES
0 800 1600 2400 3200 KILOMETERS

Distances are true on all mid-meridians and on all parallels from the equator to latitude 40°

The HOMOLOGINE projection by Professor J. Paul Goode, 1923, is an equal area projection; that is, a square inch anywhere on the map represents the same number of square miles of the earth's surface as any other square inch on the map. For this reason areal distribution can be shown upon it without error.

THE DISTRIBUTION OF THE ASS AND MULE

The Ass

The Ass was domesticated in very early times by the Pre-Dynastic Egyptians and the Sumerians of Mesopotamia.(1) It seems to have originated in Northern Africa, where races of wild asses are still found.(2) The Egyptians used asses extensively and exported them to the surrounding regions. The animal seems to be a form of horse adapted to living under rugged conditions, eating tough, hard, fibrous grass, enduring heat and drouth, and protecting itself by its fleetness. The animal is thus well fitted for the dryness of the Mediterranean region, and is distributed widely over the surrounding land. Because it is very sure-footed it is used in regions of broken up topography, and where there are small land holdings, and has become the family companion of the lower classes over a large part of the world. It spread from its original habitat by two routes: the first through the Atlas countries formerly connected with Spain, and the other through the valley of the Nile.(3)

At present there are many varieties and breeds which vary greatly in size and form. The Spaniards introduced the Ass into South America and Mexico where it has come to occupy

(1)Encyclopedia Brittanica, Domestication of Animals.

(2) Baker & Finch, Geography of the World's Agriculture,
Page 109.

(3) Vidal de la Blache, Principles of Human Geography.
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(1) Encyclopaedia Britannica, Domestication of Animals.

(2) Huxley & Huxley, Geography of the World's Agriculture, page 169.

(3) Vidal de la Blache, Principles of Human Geography, page 336.

an important place among the poorer peoples, as it does among the peoples of the Old World. Its ability to live on almost any kind of forage, and to carry a load over rough land, have broadened its distribution. The descendents of the asses introduced by the Spaniards have become the burro which is the common pack animal of the rougher parts of our western mountain states. As a draft animal the ass is inferior only because it is so much smaller and lighter than a horse. Asses are also of great importance for the raising of mules.

The Mule

As the demand for asses increased, in the early Egyptian times, and as they became more dispersed, it soon became evident that the ass could not expand north, for it could not endure the cold. In order to offset this it was mated with the mare, and the mule was the result. Mules appear in Assyrian sculptures, saddled and bridled as to-day. (4) Early centers developed where mules were bred and marketed; in Homeric times Armenia and Cappadocia were the chief of these. The mule soon became distributed over a wide area, for early records show that it was used in Northern China. At present mules are scattered over most of the world, but especially in the southern part of Europe, in the mountains of South America, in Ireland, and among the Negro farmers of the southern United States. Owing to their hardiness,

(4) Vidal de la Blache, Principles of Human Geography.

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(4) Vidal de la Blache, Principles of Human Geography.

stolidity, sureness of foot, and ability to subsist on meagre forage, the mule, like the ass, is the beast of burden of the dry rough lands, and of poor families. (5)

In fact mules are one of the most remarkable examples of animal strength and agility in transportation. They are stronger than the donkey, more sure-footed than the horse, and can do better than either the soft-footed camel, the Yak, or Llama, the work of climbing to great heights and carrying a load over rough trails. Their agility of limb, and thick strong hoofs make this possible, and their even temperament makes them superior in steep, rugged places where keeping to the narrow path requires constant effort and attention. The mule path is a characteristic of certain regions which otherwise would have no communication whatsoever with the outside. Mules were used in the Alps before there were highways, and are still very necessary in the peninsulas of southern Europe,-- the Atlas, Pontus, Armenia, and the western borders of China, as well as in Spanish and Portugese America. (6)

A comparison of the map of mules with that of horses will show that for the most part the mules are most plentiful in areas of fewer horses, and that the distribution of the mules supplements that of horses. The region of the southeastern part of the United States is colored yellow on the map of horses, showing that there are fewer horses there,

(5) Baker & Finch, Geography of the World's Agriculture.
Page 114.

(6) Vidal de la Blache, Principles of Human Geography.
Page 373.

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(3) Baker & Wilson, Geography of the World's Agriculture,
Page 114.

(4) Vidal de la Blache, Principles of Human Geography,
Page 272.

while this same area is about the only part of the United States which has many mules. In this case the mules are used chiefly by the cotton-growers, many of whom are Negroes, working small holdings, and more or less poverty stricken. Besides this, however, the climatic conditions of this area are not the best for horses, and so even otherwise, mules would tend to replace horses. Spain is another typical instance, for the climate is hot and dry, and few horses are raised, while many more mules are found. In the mountainous islands of Sicily, Corsica, and Sardinia, there are practically no horses, yet these are the regions of many asses and mules.

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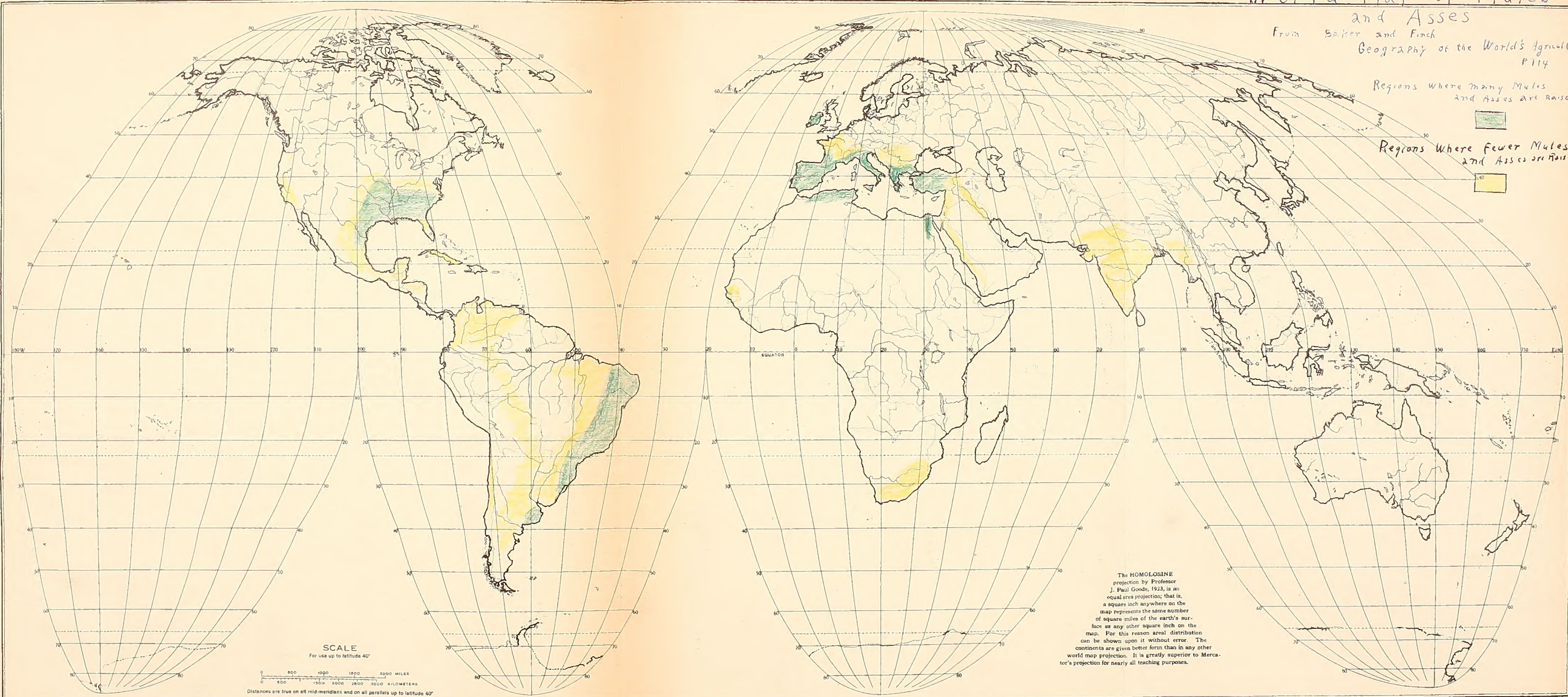
World Map of Mules and Asses

From Baker and Finch
Geography of the World's Agriculture
Pl. 14

Regions where many Mules and Asses are raised



Regions where fewer Mules and Asses are raised



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SCALE
For use up to latitude 40°
0 500 1000 1500 2000 2500 3000 MILES
0 500 1000 1500 2000 2500 3000 KILOMETERS
Distances are true on all mid-meridians and on all parallels up to latitude 40°

THE DISTRIBUTION OF CATTLE.

General Distribution.

Cattle, like horses, sheep, dogs and pigs, have been domesticated a very long time, for evidence of their domestication which dates to about 8,000 B.C. has been found in Asia. In Europe, in the pile dwelling deposits, similar evidence dates to about a thousand years later. (1) Cattle were domesticated in Egypt about the same time as in Asia. All these cattle seem to have been derived from Asiatic species and not from the European wild cattle. (2) The domestication of cattle must have been even a greater advance than the domestication of horses, for although the latter are more speedy for transportation, and more even-gaited for riding, cattle can do nearly all that horses can do, and are not so hard to care for nor require such high-grade feed. They also mature somewhat more quickly than horses, supply more milk, and are a very valuable food supply. Beginning with this very early time, cattle were spread from their original habitat all over Asia, Europe, and into Africa. The different varieties which were spread became further adapted in the different localities, by the action of climate, soil, vegetation, mutation, survival of the fittest, unconscious selection, and man's needs and desires.

As man developed a distinctive culture in the different areas of his settlement, his needs and desires came to vary,

(1) H.F.Cleland, Our Prehistoric Ancestors. Page 107.

(2) C.A.Ellwood, Cultural Evolution. Page 126.

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one region from another, and accordingly the specialization of his animals, cattle included, differed also. These uses for animals were not necessarily determined by rational processes, for primitive man is not rationalistic, but rather is emotional, imaginative and impulsive. His ideas of domestication, like many others of his customs and beliefs, originated because of some accident, notion or temporary condition, and were later rationalized and incorporated into his religion and social customs, as though caused by some carefully worked out and necessary policy. (3) In China and Japan the adults use no milk, while in India the Hindus, who comprise about seventy percent of the population, will not eat the meat of cattle. In China and Japan we would hardly thus expect to find highly specialized dairy cattle, nor to find in India highly developed beef animals. In India cattle are used for transportation, and practically nothing else. The aged and worn out cattle are not killed but are allowed to die a natural death, because of a religious veneration for them. On the other hand, the Europeans do use milk and beef, so there we find animals developed for both purposes. Cattle have thus been bred by man to fill special requirements: meat, milk, cream, butter, beauty, and work. The local conditions are usually such that cattle to be used for one purpose only, can be raised to good advantage, but in certain localities,

(3) Berthold Laufer, Methods in the Study of Domestication.

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under certain conditions cattle can be raised for more than one purpose. Much more often the former condition prevails, and the climate favors dairying in one place or beef cattle in another. Where feed is plentiful and demand is great, both dairy and beef cattle may be profitable. The other uses of cattle are usually only side issues of these two, with the possible exception of their use for transportation.

In general the distribution of cattle is very similar to that of horses, except that cattle are used for more varied purposes, each of which is affected by more or less local conditions. As with horses, the economic condition of the people, and the type of climate and vegetation are the prime importance. Since fewer cattle are used for transportation in the more prosperous regions, and more are kept for other purposes, the connection between the population and the number of cattle is not so close. A horse ten miles from the owner is of little use to him, but cattle may well be kept that far away, and when needed for food or sale, can be driven to a more desirable location.

Beef Cattle.

The distribution of beef cattle depends on the presence of an abundant and fairly inexpensive source of food for the animals. Rainfall is thus an important factor, for enough precipitation is necessary to allow grass to grow. If, however,

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a region is well watered, and fertile, other crops or animals are likely to be more profitable and drive out the beef industry. On the other hand, if beef is necessary enough, and the price received sufficient, even the fertile regions may profitably be put to that purpose.

The great regions of beef-production are the grassy plains of the western United States, Argentina, Australia, and Central Europe. In these localities the wild grass is abundant enough to supply grazing for large numbers of cattle. The rains must be evenly enough distributed to maintain the pasturage, and the winters not unduly severe, or shelter for the cattle is necessary and fodder must then be provided, since the grass would be covered by snow. Uruguay and the eastern part of Argentina is probably about the most ideal beef producing regions of the world, for all these conditions are there fulfilled.

In the United States the beef industry reaches its greatest density in the western part of the corn belt and extends southward through Oklahoma and Texas. Both corn and hay are cheaper in these states, and the most profitable use for these crops is for feeding and fattening cattle. So used, more profit can be realized than by selling and shipping the corn or the hay to other points. Further west, where the rainfall is not sufficient for the production of crops, the wild grass is utilized for grazing of cattle. The animals which are raised here are usually shipped to farmers in the corn belt to be fattened

A region is well watered, and fertile, other crops or animals are likely to be more profitable and drive out the beef industry. On the other hand, if beef is necessary enough, and the price received sufficient, even the fertile regions may profitably be put to that purpose.

The great regions of beef-production are the Great Plains of the western United States, Argentina, Australia, and Central Europe. In these localities the wild grass is abundant enough to supply grazing for large numbers of cattle. The range must be evenly enough distributed to maintain the pastures, and the animals not unduly severe, or shelter for the cattle is necessary and food must then be provided, since the grass would be covered by snow. Progress and the security of Argentina is probably about the best that can be made during range of the world, for all these conditions are there fulfilled.

In the United States the beef industry reaches its greatest density in the western part of the corn belt and extends as far west through Oklahoma and Texas. Both corn and hay are cheaper in these states, and the most profitable use for these crops is for feeding and fattening cattle. To feed, more profit can be realized than by selling and shipping the corn at the day to other points. Further west, where the rainfall is not sufficient for the production of crops, the wild grass is utilized for grazing of cattle. The animals which are raised here are usually shipped to farmers in the corn belt to be fattened.

before being sent to the great packing centers at Chicago or Kansas City. In the regions of spring-wheat in Minnesota and the Dakotas, the dairy region of eastern Wisconsin, New York, and New England, and in the cotton states of the south where the cattle tick holds forth, little is done with beef production, for the necessary feed cannot be produced at prices which can compete with the other regions, and the local specialization is more profitable to the farmer.

In Europe, the country to have the greatest influence in beef production, has been the United Kingdom. Although Britain does not rank especially high in the number of cattle raised, it has developed about a dozen beef, or dual-purpose cattle, which have been introduced into many other countries to improve the breed. The most important of these English cattle are the Shorthorn, Hereford, Aberdeen-Angus, Galloway, Red Poll, Devon, Sussex, and West Highland. These are so much in demand, that the British farmer has a considerable income from the exportation of breeding stock. The British only produce about 60% of the beef required for their own use. Yet considering the small size of the country and the dense population, ^{their beef production} must clearly be very intensive.

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that sufficient feed for the animals cannot be produced, and importation of grain and of flaxseed and cottonseed cake is resorted to, to supplement the local feed supplies. Through much of the northern part of Europe the climate is cool and moist, and not suited to raising grains, but such climate is ideal for cattle-raising. These countries have a definite governmental policy of encouraging farmers to raise much livestock and so increase the food resources of the country. The Russian cattle are poor in quality and the industry is declining. Although there are many cattle in the country, more, in fact, than in any other European country, there are only one-fifth as many per square mile as in Germany. Italy is the chief Mediterranean cattle country, most of the cattle being raised in the Po Valley. (4) The industry is not favored by the Mediterranean climate, for the summers are so dry that the pasturage is reduced.

Dairy Cattle.

The demands of civilization for milk and milk products, have resulted in the specialization of cattle for milk production. The primitive or less advanced peoples use cattle indiscriminately for milk, beef or draft purposes, without attempt at improvement of the breed for the special demands.

(4) Baker and Finch, Geography of the World's Agriculture.

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This condition prevails throughout most of Europe, for the most part, except in the northern part where greater demand and competition has spurred the farmers to specialize and devote some attention to improvement of breeds.

The dairy industry depends quite closely on the climate, being favored especially in regions of fairly cool, moist summers. This optimum is partly because of the aid of a cool climate in preventing bacterial growth in the milk, but more because of the abundance of fodder usually found in such regions. This fodder is very important, for the dairy cattle are such highly specialized animals, that their flow of milk is seriously impaired if they are required to eat inferior food, or have to wander about picking up bits of grass here and there. Certain breeds of cattle, however, can do relatively better on scanty feed than others. In general, the development of dairying requires favorable conditions, unless overbalanced by unusual local demand, which might allow it to spring up to a limited extent. Florida is not climatically favorable for milk production, yet the large population of the resorts and cities demands fresh milk, which must be supplied locally in spite of the climate. So also in New England, the expense of labor, feed, and of housing cattle through the severe winter would make the farmers unable to compete with other regions in milk production if it were not for the demand for fresh milk in the many nearby cities. Very little of the milk raised in

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New England is used for making butter or cheese, for the great dairy states of the Middle West can produce these products at a price which completely drives the New Englanders out of this phase of the industry. Thus the placement of population, the effect of climate in the production of fodder, the abundance of cheap feed, and the lack of more profitable activity determine most of the distribution of dairying.

As in the case of beef cattle the United Kingdom has contributed to the world the largest number of famous breeds of dairy cattle. Of these the better known are the Jersey, Guernsey, Ayrshire, and the Kerry, as well as the Devon, Shorthorn, and Red Poll, used for both milk and beef production. From the Continent have come what are known in America as the Holstein-Freisian and the Brown Swiss. The development of these European breeds presents an interesting example of how climatic influences coupled with man's directive and selective powers can change animal form. The Holstein-Freisian cattle originated in the parts of the Netherlands which are nearest the North Sea, where the climate is cool and moist. The soil is a heavy clay and the grass produced is luxuriant, but has a high percentage of water and a correspondingly low content of nourishment. The result is that the cows are large, big-boned, and rather angular. They have large digestive capacity, and seemingly as a result of the large quantities of watery food, produce large quantities of milk, which is lower in percentage

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of butter fat and solids than the milk of other improved dairy breeds. Such cattle can produce more milk in a year than any other breed, and although the cream percentage is small, the total amount of cream in a year will also be more than of other breeds. They are good for any region which has rough and rather bulky vegetation, but to do well must have a large quantity of succulent feed. The Ayrshire breed was originated on the uplands of Ayr in Scotland, where the disagreeable climate and poor, thin soils produce coarse and scanty forage. These Ayrshire cattle are well adapted for rough land where other cattle would not do so well. The Jersey and Guernsey cattle have developed under very different conditions. Their native islands are mild and the climate is much drier than that of Holland. The soil is a light loam and the vegetation is not abundant, but is comparatively high in nourishment and low in water content. These cattle do not consume the large quantities of food which the Holsteins do, and are of moderate size, finely boned, and well proportioned. Their milk is rich in fat and solids, and of only moderate quantity.

The dairying of Europe centers around the North Sea, although Ireland and northwestern France are also important. Denmark is usually cited as a typical and ideal dairy country. The Danes have added to this idea by a careful policy of improving the products and educating the neighboring countries to believe that the Danish dairy products excell all others.

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They have been so successful in this that the well-to-do Englishman would scarcely think of eating other than Danish butter for which he has paid a fancy price, while the Danes meanwhile are importing oleomargarine for their own use.

In countries which have no easily accessible market, much of the milk is made into butter or cheese. The latter can better stand delay in transportation, and warmer climate, and so is usually made in the more remote localities, and in the Mediteranean countries.

Over one-fourth of the dairy cows in the United States are found in the four states of Wisconsin, New York, Iowa, and Minnesota. Many are also kept in the Northeastern States, where well-distributed rainfall favors pasturage and hay production, and the season is not too short or cool to prevent the growing of corn for silage. The many cities, as already mentioned, give a market for much of the milk, and in the more distant places butter and cheese are made. There is also a suggestion that the large amount of dairying in the region may be influenced by the presence of many farmers of English and Teutonic origin, who have been accustomed for generations to the methods of dairying. (5)

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Cattle For Transportation

For draft purposes the cattle are patient, strong and inexpensive, and have been widely used for this purpose in large numbers. They are, however, so slow that they are not usually used by the more progressive people when any other form of draft animal, such as the horse or mule, is available. In America their use is falling off rapidly, and it is quite seldom that one finds oxen, even in the remote districts. In Europe cattle are much more commonly used for transportation, for they are cheaper to raise than horses, and are available to any farmer who has cows. Their feed is less expensive, and they are not so subject to disease or so easily disabled by abuse. The greatest numbers of cattle are used for transportation and draft in the less progressive countries. Central Europe uses many for this purpose. In the more arid countries they are not so well adapted, and being harder to raise are

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India is the country of the world where the most cattle are raised for transportation. The climate is not such that the European breeds can live, and they are replaced by other species. The chief of these are the Brahman^{or Zebu}, gayal, banteng, water buffalo, and in the highlands to the north, the yak. These animals are not as valuable as the European cattle, but since the latter cannot be raised, they are replaced by those which can endure the conditions. The very fact that an attempt is made to replace the cattle in an unfavorable environment, shows the value of the animals to man, for had they not been necessary, the people would have done without them. Throughout all the tropical countries the difficulties in the way of raising domestic animals are many, for there are diseases which kill the animals off, extremes of climatic conditions, heat, moisture, and drouth, and the rank growth of the grass, which is frequently so bulky and reed-like as to offer little nourishment. These factors allow only animals which are naturally adapted to the environment to survive. The climates of the different parts of India offer considerable variation, and as the conditions vary, so do the cattle used.

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and not be susceptible to insect pests. In the southern part of India where the climate is steadily hot and moist, the gayal largely replaces the Brahmans, while in the northern, snowy plateaus of the Himalayas the yak is the dominant animal.

(6). This yak, with its short legs and sturdy build, is indispensable for traversing the mountains of eastern Tibet, but it can live only at the great altitudes, and quickly dies when brought down to the lowlands. (7). In the hot moist regions to the south, besides the gayal, is the water buffalo, or carabao. This animal can live only where there is an abundance of mud and water. It is the chief work animal of the wet rice fields of India, Ceylon, Burma, Indo-China, and the Philippines. Its endurance is not great, and it must be allowed to wallow in the mud or water every few hours, yet it can work without harm in the mud of the rice fields and so is of inestimable value to the inhabitants of this thickly populated region.

(6) Huntington and Williams, Business Geography.

Page 199.

(7) Vidal de la Blache, Principles of Human Geography,

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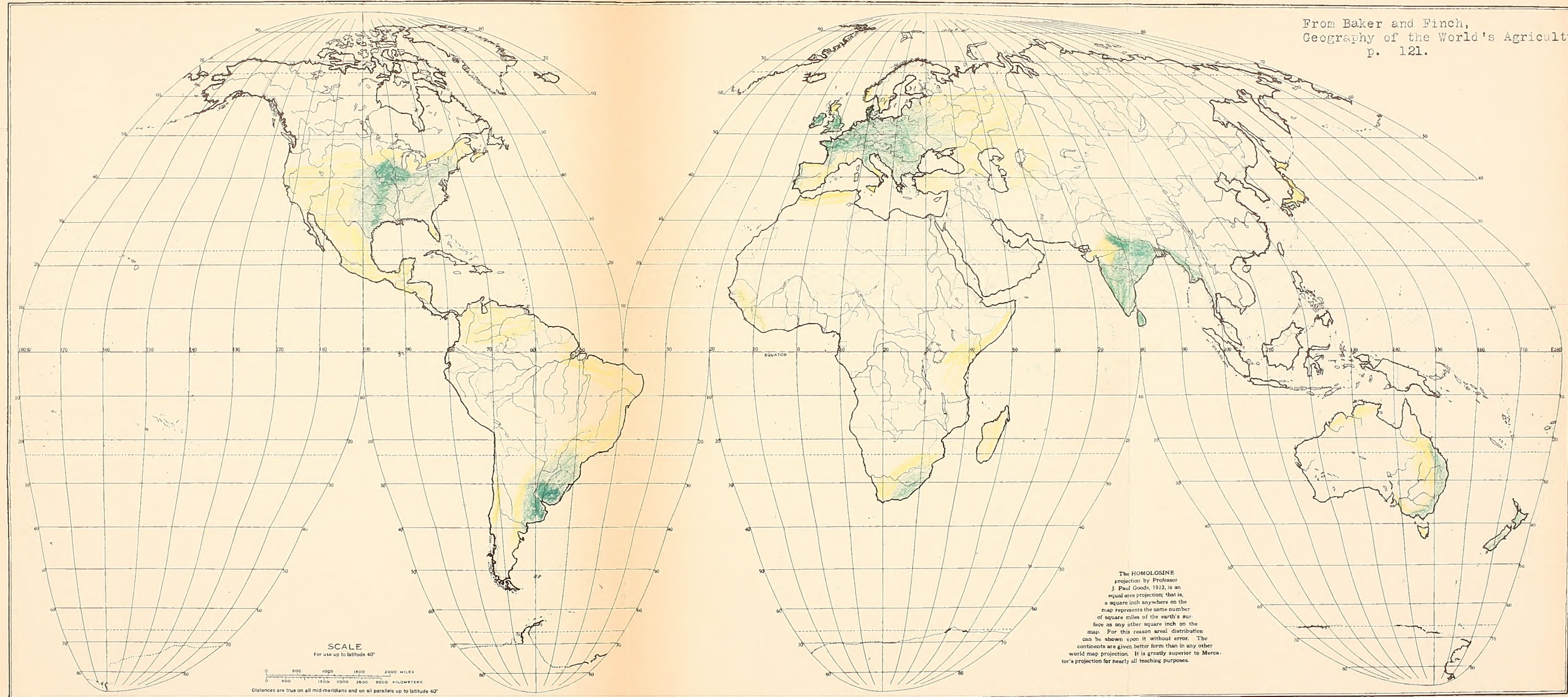
(6) Huntington and Williams, *Business Geography*.

Page 199.

(7) Vidal de la Blache, *Principles of Human Geography*.

Page 303.

From Baker and Finch,
Geography of the World's Agriculture.
p. 121.

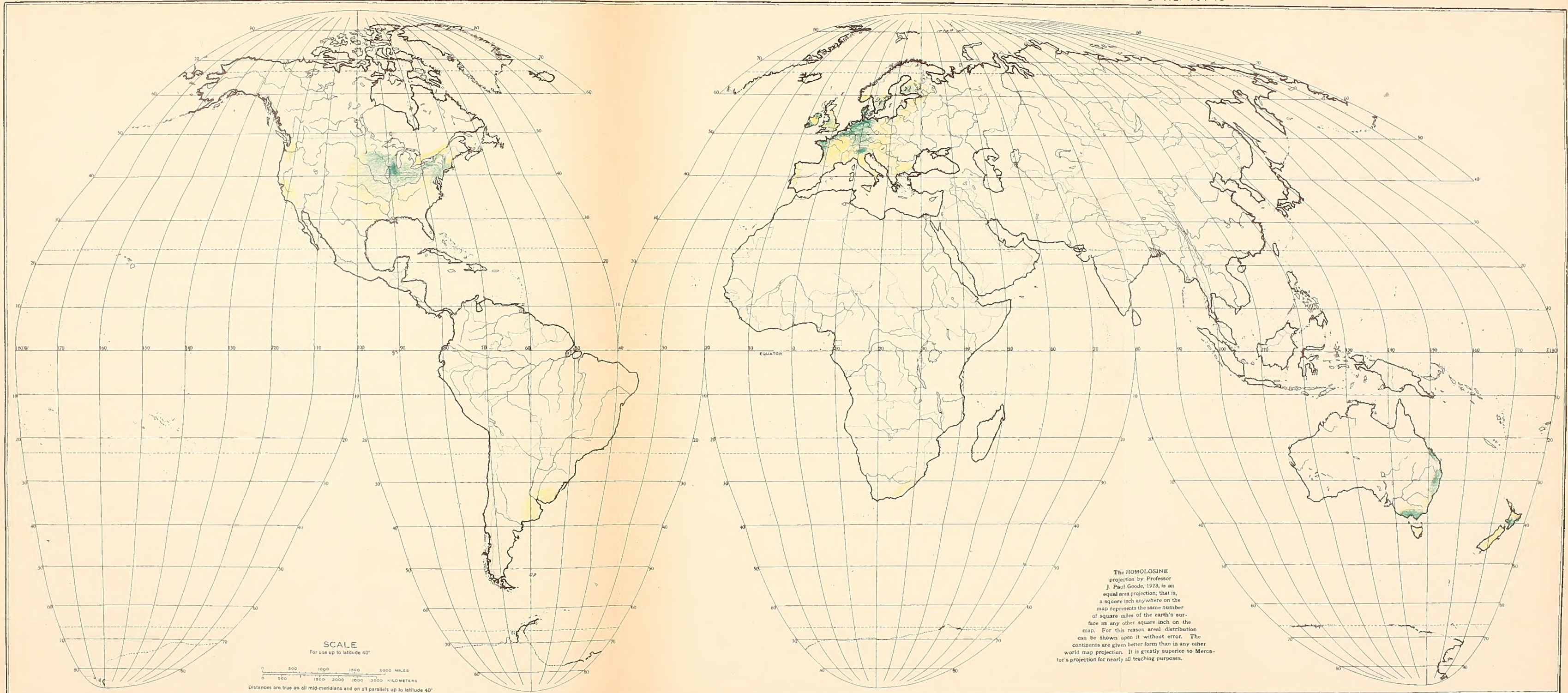


SCALE
For use up to latitude 40°

0 500 1000 1500 2000 MILES
0 500 1000 1500 2000 KILOMETERS

Distances are true on all mid-meridians and on all parallels up to latitude 40°

The HOMOLOGINE projection by Professor J. Paul Goode, 1913, is an equal area projection; that is, a square inch anywhere on the map represents the same number of square miles of the earth's surface as any other square inch on the map. For this reason areal distribution can be shown upon it without error. The continents are given better form than in any other world map projection. It is greatly superior to Mercator's projection for nearly all teaching purposes.



THE DISTRIBUTION OF SHEEP

Historical Background

Of all the animals necessary or useful to man, sheep certainly rank with the most important. From the wool man gets clothing, blankets, rugs, felts and other coverings; the flesh of sheep provides mutton for all peoples who can obtain it, except the Buddhists, whose religious beliefs forbid. Many people use the milk of ewes, either as milk, or in the form of cheeses, and curd. The lambs of some of the Asiatic fat-tailed breeds yield the fur known in commerce as Astrakhan. The fat-rumped breeds appear to be a source of a very large proportion of the Russian tallow. (1) Mutton tallow is important for a large variety of uses. The skins with wool or hair attached are used for rugs or garments, and when tanned these skins become an excellent thin leather, and are also used for parchment. Horns and hoofs are a source of glue. In some places, as in Tibet, sheep are used as pack animals.

From where did these valuable animals come? From what source did they originate? To answer these questions we naturally turn to the existing species of wild sheep.

There are scattered over the world many species of wild sheep. Although these are apparently ^very different from the domesticated sheep, they bear the characteristics which distinguish sheep from the other genera of the family Bovidae, and place them in the genus Ovis. Such a feature is the skull development, since the face bends downward at

(1) R. Lydekker, The Sheep and Its Cousins.

more of an angle from the space enclosing the brain. This gives prominent ridges over the eyes. The muzzle is smaller; the base of the horns is more forward, and the horns have a typical development. Glands are present in the groin, below the eyes, and between the two main toes of the feet. Strange to say, the presence of wool is not at all a distinguishing feature, since all the wild sheep and even some of the domesticated ones are covered with hair. This is largely the reason for the different appearance of the wild sheep compared with the domesticated ones.

The wild sheep also present some other differences which make our question difficult to answer. Indeed, scientists have been unable to answer it with entire satisfaction, and the origin of sheep is still uncertain. It is known that the group is a comparatively modern one originating not before the latter part of the Tertiary Period, that is, just before the Pleistocene or Glacial Epoch. This can be ascertained by fossil remains.

Man early domesticated sheep, with the result that wild forms under unnatural conditions of domestication developed certain characteristics. It seems possible that some Asiatic wild sheep, now extinct, and the Mouflon or European wild sheep, formed the present stock.

The details of how these early half wild sheep changed to the domesticated sheep known at the opening of historic

time are hidden and forgotten. We do know, however, that long before historic time, sheep were domesticated. Very early records referring to them are found in Egypt, Greece, and among ruins of the Swiss prehistoric Lake-Dwellings. Probably these animals were brought by tribes migrating from the east. We know that under the different environment of domestication, and selective breeding, animal forms will rapidly modify. Man carried his animals with him as he changed his abode, and again under differing conditions and environment, new characteristics were developed in the sheep. These changes became in time so pronounced that the sheep came to represent different breeds. The exact steps, however, are unknown and lost in the hazy uncertainty of prehistoric time.

In nature sheep inhabit the more open, dry uplands, usually not frequenting the forests and brush. They can subsist on rather scanty feed, are wary, agile, and depend for safety on their fleetness and protective coloring. The domesticated sheep have changed decidedly. They have lost their protective coloring, their fleetness, agility and cunning. This change is doubtless due to many centuries of protection where the needs of the animals were different. Under such artificial conditions, animals change much more rapidly than they would in the wild environment.

Some of the More Important Breeds of Sheep

The wants of people differ with the locality. Their necessities must be supplied somehow, and will usually be procured in the most convenient and effective manner. Thus it is that the sheep of these localities will be developed by the people, along those lines which best supply their wants. Some regions need sheep that can thrive on rugged land and withstand harsh weather, and supply food and wool. Other regions must have sheep which can develop rapidly on thickly populated areas under intensive agriculture. These sheep need not be so hardy, but must be able to give more immediate profits. Certain breeds have survived the test of time and scientific agriculture, and are used the world over to fill the needs in different regions.

The two regions from which these important breeds come are Britain and Spain. We may consider the British sheep as coming under three general groups. The first group is the forest and mountain group. At present its most important representative is the Cheviot, which comes from the Cheviot range in the south of Scotland and extends into Northumberland. They are a good all-around sheep, being very hardy, and having mutton of a good quality. Their fleece is of only a moderate quality or quantity, and inclined to be hairy on the hind surface of the thighs.

The second group is the ancient uplands breeds, which yield fine short-wooled fleece, and good mutton. Of these

the Dorset, Hampshire, Southdown, and Shropshire are popular representatives. The Southdown is perhaps one of the most favorite breeds in existence in spite of the fact that its wool is inferior.

The third group is the long-wooled British sheep. These sheep have developed in the low-lying alluvial land where feed is abundant and rich. They are larger in body, longer legged, producing long, coarse wool which is, nevertheless, soft to the touch. The Lincoln breed is popular in parts of England, Argentina, South Africa, and a few other places. The Romney Marsh sheep are also large, long-wooled, and are claimed immunity from foot rot when raised on wet ground. They are not raised much elsewhere except in Australia and New Zealand. The Devonshire is a valuable breed attaining great bodily size. The Leicester and Cotswold are also popular breeds, having a wide distribution through most sheep-raising countries.

Each of the English breeds is named from the locality where it developed. Their differentiation came about from long years of unconscious selection and adaption to different conditions, aided by the barriers which cut up the land, and would have prevented any wide-spread mixing of the breeds, especially in early times.

Before the Christian Era, Roman writers recorded that the finest wool, which was used in making the garments of the wealthy and nobility, came from Spain. So it was that

fine-wooled sheep were raised in Spain at a very early time. These sheep, through passage of time or crossbreeding, ripened into the Merino which are now raised the world over. From very early time Spanish sheep were divided into two groups, those which remained all the year in the same pasture, and those which migrated in the spring and summer to graze in the mountain pastures. These travelling flocks had the protection of the king and were allowed to graze on any property during their passage, even at the expense of gardens and crops. This practice discouraged farming and encouraged sheep raising. These migratory sheep living on the best of the land were the Merinos. Their wool was exported from Spain for many years and deemed a great luxury. The King of Spain forbade the exportation of the sheep, and although a few attempts were made to smuggle them out of the country, it was not until 1783 that any number were permitted to leave.

Louis XVI of France was more interested in farming than governing. He had developed an experiment farm at Rambouillet, about forty miles from Paris, and here he established a flock of three hundred Merino sheep purchased from the King of Spain at his special request. In Spain the different flocks vary widely in minor points. The flock the King of France purchased was composed of sheep chosen as the best from many flocks in Spain. This flock of three hundred, then, made up of beautiful individuals, was a very uneven and heterogeneous group. This was in 1783. The sheep were carefully

fed, housed, and cared for, the flock maintained and interbred. In the course of a century, by careful selection, the individuals of this flock became very large, smooth-bodied sheep, bearing a heavy fleece of long, fine wool. They are now known as a distinct breed, the Rambouillet. Since 1840 they have been widely exported to other parts of the continent, Australia, Argentine, and the United States.

Principles of Wool Production

In most regions sheep are raised essentially for the wool they produce, and are thus bred for the quality and quantity of wool. In some places, however, due to a nearby market or to refrigeration facilities, the mutton and lambs are a very important factor in the industry. This is increasingly true at present with the extension of refrigeration. There is now scarcely any part of the world, where sheep raising is important, which cannot ship the excess of the flock to some market, in the form of frozen meat. This added possibility of profit influences the breed of sheep to be raised, because the best wool-producers are not necessarily the best mutton producing sheep.

The English breeds, though relatively poor wool producers, are excellent mutton producers, while the merinos are the world's best wool producers but have inferior mutton. Thus many persons raise cross-breed sheep to gain some of the advantages of both breeds. Such cross-breeding is

low, dense, and coarse, the light-colored and inter-
laced. In the course of a century, by natural selection,
individuals of this flock became very large, strong-
bodied, bearing a heavy fleece of long, fine wool. They are
now found in a limited area, the south-west. About 1850
they were still reported to have been at the south-
west, but later, perhaps, and the British Isles.

Evolution of Wool Production

In most regions where the climate is generally favorable for the
wool sheep, and the land for the woolly and
growth of wool. In some places, however, the woolly sheep
cannot be so easily introduced, and the woolly sheep
are a very important factor in the industry. This is because
they are not so easily introduced as the woolly sheep.
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is not so important, which cannot be the wool of the
flock of the world, in the form of wool. The wool
is not so easily introduced as the wool of the world.
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The best wool producers are often found in the same of
the world's best wool producers.

satisfactory when desired, because sheep blend evenly the characteristics of the parents. As, for example, a fine-wool interbred with a long-wool sheep is better adapted to range conditions than the long-wool sheep, and better for butchering than the fine-wool sheep. On some lands it is not practical to raise crossbreed sheep, and Merinos and Rambouillets are more profitable.

In general, the finer the wool, that is, the smaller the diameter of the fibre, the more valuable it will be when cleaned. Cleaned, because there is a great difference in weight between wool as it comes off the sheep's back, "greasy", and after it has been "scoured", or cleaned. The wool grower sells the wool greasy, or in some places "washed", which means that the sheep were washed in cold water before being clipped. This of course reduces the shrinkage. A purchaser of wool calculates the amount of shrinkage there will be and pays accordingly. Wools of high shrinkage are not very attractive, nor readily sold; they are expensive to ship and hard to scour. Shrinkage varies from thirty to eighty percent. That is, one hundred pounds of fine wool which weighs thirty-eight pounds after scouring, is said to have a shrinkage of sixty-two per cent, and a yield of thirty-eight per cent.

Shrinkage is a very important problem in sheep raising, and a difficult one to meet, because the grower can do little to reduce it. Fine wool shrinks the most. The greatest element in shrinkage is the amount of "yolk" or grease which the sheep secretes. This amount varies with individuals and with breeds, Merinos having a relatively large amount.

From this yolk comes lanolin, which is the basis for most cold creams. Besides the amount of yolk, climate and soil conditions are very important. Rain tends to wash the dirt out of the wool, while dry or sandy soils catch in the wool and cause high shrinkage. This actually influences the wool enough to greatly reduce the value of it from certain regions. Burrs, seeds, chaff and other vegetable materials are also very bad because often they will not come out in the scouring process. If allowed to remain in any great quantity they will clog up the machinery in manufacture. For wools in this condition an extra process is necessary, "carbonizing" the wool. Here the vegetable matter is removed by a chemical process. The term is really a misnomer, for the vegetable matter is carbonized, and not the wool.

Other desirable features in the wool are reasonable length of fibre (not too long or the value will be reduced), crimp of the fibre (it should be uniform from base to tip and closely crimped), and softness to the touch. Absence of hair, kemp, and black or grey wool is vital because these fibres will not take dye and might ruin a piece of cloth.

The reason that fine wool is worth more than coarse seems to be that the supply of this wool has never reached the demand. As it is used also for the more expensive goods the higher price is obtainable from the ultimate user of the manufactured material. This does not mean, however, that the other grades of wool are not in demand. All grades

of wool are necessary in present day wool manufacturing, but the wool used for a carpet could scarcely be expected to be worth as much as the same amount of fine wool used for babies' blankets.

Some of the Chief Sheep Raising Regions of the World.

When raised on a range sheep are less profitable per acre than cattle, and will thus usually be raised on land which is not favorable for cattle raising. There are, however, regions where sheep are raised profitably on excellent land, but this is due to the effect of other conditions. Sheep raising in general is carried on in the areas of rough, cheap land, and usually where it is relatively dry. Sheep can, moreover, thrive on land where cattle would starve, because their smaller muzzle permits closer cropping of the grass. Sheep are often raised on stony, calcareous soil which is not easy to cultivate. (2)

The quality and quantity of wool produced in a given country depends on many factors. Some of these are soil, climate, topography, vegetation, occupation of the people, transportation facilities, etc. So important is the element of soil that the wool from different parts of the same country varies widely.

(2) Jean Bruhnes, Human Geography. Page 300.

The greatest sheep raising region of the world is Australia, and wool is the most important export of this country. Since sheep can secure pasturage where cattle cannot, many of the semi-arid regions can support sheep. In Australia the winters are so mild there is no problem of winter housing. The soil is dry, and thus the sheep are healthier. Although in a remote situation, Australia may safely ship wool long distances as this product is non-perishable.

The first sheep to be introduced there were from South Africa. These did so well that Merinos were soon imported. Since then sheep raising has increased very rapidly. Australia has specialized in the Merino sheep, and is now recognized as producing some of the world's best wool. The Merino is not the only breed raised here, for only about one sixth of the Australian wool is from these sheep. With the improvement of refrigeration many of the mutton breeds have been introduced and much frozen mutton is shipped to England.

Argentina ranks second in the production of wool, with a total of 314,800,000 pounds. Here also the wide expanses of semi-arid land, the Pampas, offer ideal sheep raising conditions. Until forty years ago the southern part was uninhabited, wind-swept pampas -- flat land, covered with scrub and grasses. There are now some 18,000,000 sheep grazing on it. These sheep are chiefly a crossbred Romney Marsh. This gives a hardy, long-woolled sheep of good size, with heavy though coarse fleece, and with good mutton.

The greatest source of light in the world is
the sun, and it is the most important source of light
for all life on earth. Since the sun is so far away,
its rays take a long time to reach us. In fact, it
takes about eight minutes for the light to travel from
the sun to the earth. The sun is a very hot body,
and it is the source of all the heat and light that
we receive. Without the sun, life on earth would not
be possible.

The first step in the process of photosynthesis is
the absorption of light energy. This is done by the
chlorophyll in the leaves of plants. The chlorophyll
molecules are arranged in a way that allows them to
capture the light energy. Once the light energy is
captured, it is used to drive the chemical reactions
of photosynthesis. The first of these reactions is the
splitting of water into hydrogen and oxygen. This
process is called photolysis. The hydrogen is then
used to reduce carbon dioxide into glucose. The oxygen
is released into the atmosphere. The overall process
of photosynthesis can be summarized by the following
equation: $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$. This
process is essential for the survival of all life on
earth. It is the primary source of energy for all
other organisms. Without photosynthesis, life on earth
would not be possible.

The United States, with a total of 311,501,000 pounds, ranks third in wool production. This amount is divided up into states. The wool from each state is different, and in places the wool from different parts of the same state differs. An example of this variation is found in the case of California. The wool from the northern counties is of Merino extraction and is the best produced in the state. It is light in shrinkage, bright and free from vegetable matter. The middle-counties' wool is less valuable; not so much of it is Merino; and especially in the fall clip, much of it has to be carbonized. The southern-counties' wool is of shorter length, higher shrinkage, with much sand and dirt. It is thus less desirable.

Texas is the greatest wool-producing state in the United States. Some of this wool ranks with the best in the country for certain purposes. Next to Texas in the order of the amount of wool they produce come Montana, Wyoming, California, Utah, Oregon, Ohio, Idaho and New Mexico. New York state also produces considerable fine wool.

The fourth country in wool production is New Zealand. Formerly ranking eighth, and raising mostly Merino sheep, it has greatly increased the production recently, and now also raises many of the long-wooled breeds.

South Africa, ranking next, produces some very fine wool, too fine to be used in any quantity in this country on the machinery with which the mills are equipped. This wool is too mushy for ordinary manufacture and is used especially for babies' blankets and clothes.

The United States, with a total of 11,000,000 sheep, is the largest producer of wool in the world. This amount is divided into three main sections. The wool from each state is different, and in some cases the wool from different parts of the same state differs. The principal variation is found in the color of the wool. The wool from the northern countries is of a lighter color, and is the best produced in the world. It is also the most expensive, being and from the vegetable matter. The middle countries, wool is of a medium color, and is of a medium quality. The southern countries, wool is of a darker color, and is of a lower quality. The wool from each state is different, and in some cases the wool from different parts of the same state differs.

There is a great deal of wool produced in the United States. Some of the wool from the United States is used for the manufacture of cloth. Some of the wool from the United States is used for the manufacture of carpets. Some of the wool from the United States is used for the manufacture of hats. Some of the wool from the United States is used for the manufacture of other articles. The wool from the United States is of a high quality, and is of a medium color. The wool from the United States is of a medium quality, and is of a darker color. The wool from the United States is of a lower quality, and is of a lighter color.

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Russia produces a great deal of wool but it is of an inferior quality. Until recently there were places in Russia so remote from transportation that it did not pay to ship the wool, so the animals were raised for their tallow and hides only.

The wool of the United Kingdom is used almost wholly to supply the mills of that country. The demand is the essential reason for the continued raising of sheep. The industry dates back to an early time, and since the demand for wool persisted, and even increased after the industrial revolution, and the region was favorable for the breeds already established, there was good reason why sheep raising should continue. This is a good example of the influence of the early start of an industry. The wools raised in the United Kingdom come under the general heads of short, fine wools, not of combing length, and the long coarse wools. The Merino wools used by the mills come chiefly from Australia.

Asiatic Russia and China both produce a great deal of wool. Nearly all of this, however, is suitable only for carpet manufacture. It is indeed from the Asiatic countries that most of the world's carpet goods come. Besides over 60, 000,000 pounds of wool, China also exports over 2,000,000 pounds of goat hair, and over 8,000,000 pounds of camel hair.

The primitive methods of packing and handling the wool leave much dirt, and are very wasteful and expensive. The problems facing China as concerns wool growing at present

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are --improvement of the breed, production of clean wool, and, biggest of all, transportation. In the interior the wool is twisted into a rope two feet in diameter, and tied into two hundred pound bundles with goat hair. It is then either carried fifty days on camel back, or floated down the rivers on rafts made of sheep or cattle hides. If sent down the river there is great danger of the wool becoming discolored or wet. The transportation is often 41 per cent of the initial cost of the wool.

Central Europe, Northern Africa, and many other places are important wool producing regions. To give a complete account of all the important regions, the characteristics of the wool, and the problems of the region would require many volumes. Each small locality produces wool with different distinct characteristics. An expert can identify the wool by its appearance. Each grade of wool, furthermore, has a special use in the manufacture.

There was a decided decline in the number of sheep raised in Germany between 1890 and 1912. This was partly due to the German distaste for mutton, and the lack of tariff on wool. In France the decline started even earlier, in 1840. In both countries it was also due to some extent to the increasing density of the population, which tends to reduce the number of sheep raised, (3) and also to the unenclosed

(3) Jean Bruhnes, Human Geography. Page 300.

and New York from 1890 to 1914. Page 420.

and the difficulty of raising sheep where the holdings were mostly small. These countries further failed to combine sheep raising and arable farming as the English have done. (4)

One other country, Peru, presents sufficient interest to merit consideration. Professor Barker, a wool expert, says that Peru is one of the most potential wool growing countries of the world. In Peru it is possible to raise sheep at an altitude of 12,800 feet. "The wool possesses peculiar properties fitting it for special manufacturing purposes, and is thus worthy of a prominent place in the scheme of development."

Besides the wool of sheep, Peru sends to England about 4,000,000 pounds of Alpaca wool each year. Alpacas, Vicunas, and Guanacos belong to the Llama family. The Alpaca has long black or brown hair falling over its sides like a curling cascade. Vicunas have a long, very fine and silky white hair on the shoulders. This can be made into the most delicate fabrics, and wears wonderfully. Guanaco range south to Patagonia, but are being replaced now by sheep.

A study of the map of the distribution of sheep will show that the great sheep-raising regions are the somewhat arid, open grass lands which afford good grazing and thus cheap food, for sheep do well in the dryer lands. The most notable exception to this statement is found in England.

(4) J.H. Clapham, The Economic Development of France and Germany from 1815 to 1914. Page 220.

and the difficulty of obtaining sheep from the islands was
greatly reduced. These countries have been raised to a position
of high esteem and are the source of the finest wool in the world.
One of the most important of these is the island of New Zealand
which produces the finest wool in the world. It is a very large
island and is one of the most fertile and productive in the world.
It is situated in the South Pacific and is a very large island.
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notable exception to this statement is found in England.

In this one island there are more than thirty distinct breeds, and a century ago there were many more. (5) In spite of the dense population, the soil on much of the island is so sterile that sheep raising pays better than tillage. The demand of the industries for wool and of the population for mutton and lamb, has produced animals good in the production of both wool and meat. Such animals are coming to be raised elsewhere for similar purposes, under conditions of intensive agriculture, and in connection with cattle or other types of farming. Thus in the heart of the fertile farm land of New York State, and in Ohio, Michigan, Indiana, Kentucky, and Missouri, many sheep are found. While the density of sheep in these regions does not approach that of England, the conditions of production would not be greatly dissimilar, and the English breeds would predominate, for at present the lambs are of the greatest importance and wool is only secondary. In America mutton is frowned upon, and lambs are especially desired. While some of the so-called lamb purchased makes one wonder just how long an animal continues to be included in this category, the rule would hold throughout this Middle west sheep-raising region, that all the lambs not needed to maintain the flock would be sold for slaughter within the first year.

(5) Finch & Baker, Geography of the World's Agriculture.

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In raising sheep for meat, the limiting factor would be the availability of the market by means of rapid transportation, or nearness to facilities for refrigeration. So as transportation routes become more and more extended, the lamb crop becomes a possibility in more and more localities. Such change of conditions results in the raising of fewer Merino sheep, for which are substituted English breeds, or more often crosses between the English and the Merino are raised. In regions from which meat cannot be shipped because of distance from refrigeration facilities, the wool becomes the important element and selection of breed is made accordingly.

In the more primitive, or at least less advanced regions, the type of sheep raised is very likely to be left to chance and to belong to no special breed. Such animals usually produce inferior and scanty wool, and are so far from modern transportation as to be of little value as meat, other than locally. Even their use in this way is sometimes prohibited by the religious beliefs or customs of the people. Such inferior animals are raised through much of the Balkan peninsula, Russia, and the Near East.

A comparison of the map of sheep with that of cattle will reveal some overlapping between the cattle-raising areas and the sheep-raising areas, but with the exceptions of Argentina, Uruguay, the Middle West of the United States, South Africa, and New South Wales, the areas of greatest

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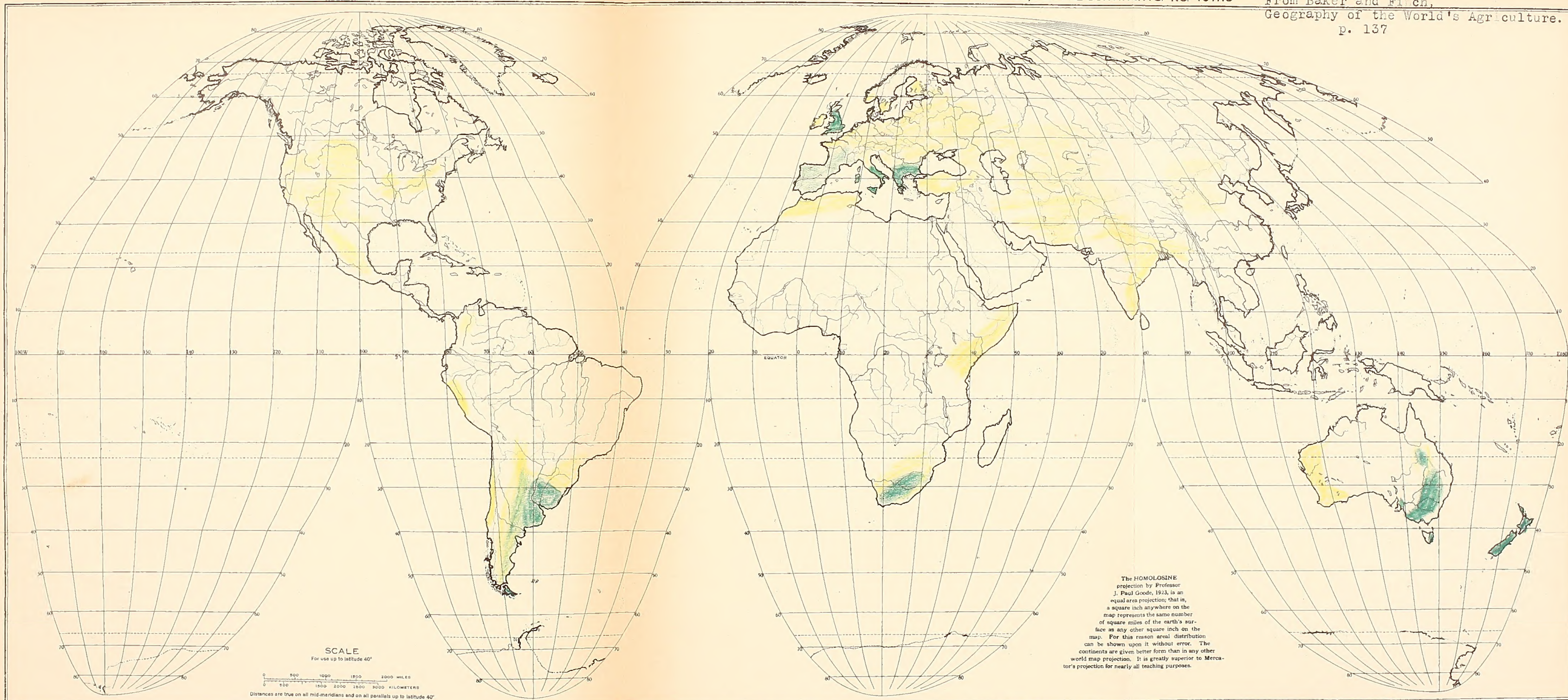
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sheep production are the areas of lesser cattle production. Except for intensive agriculture, where animals are barn fed, or fed from cut crops outdoors, cattle and sheep do not do well on the same pasture, for the sheep crop the grass so short that the cattle cannot graze. This has been the basis of the well-known strife between the cattle men and the sheep men wherever they have met on open ranges. As long as cattle do not have to graze over the pasture after the sheep, the two animals may be raised to good advantage under the same conditions and even on the same farm.

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GOODE'S SERIES OF BASE MAPS AND GRAPHS. THE WORLD ON GOODE'S HOMOLOGINE PROJECTION, INTERRUPTED, FOR THE CONTINENTS. NO. 101HC

From Baker and Finch,
Geography of the World's Agriculture.
p. 137



THE DISTRIBUTION OF GOATS

The distribut^o₁n of goats is very similar to that of sheep except that they are not raised in¹large numbers under intensive agriculture in any of the more productive countries. In fact goats are seldom found in cattle-raising regions, for they thrive on scant coarse feed and require little water. In general they are not so productive as sheep, which tend to displace them in the more favorable regions.

The goat is kept essentially for the milk by the thrifty peoples of Scandinavia, Switzerland, the Mediterranean region, and parts of Germany, France and Ireland. In many Mediterranean countries, in particular, where the summers are too dry for cattle, goats are brought down from the mountains to furnish the summer milk supply for the cities. India raises more goats than any other country in the world, but because of the dense population, the actual local importance is not so great as would be expected.⁽¹⁾ Its most important use there is for milk, but as there is no religious or other scruple attached to the goat, its meat is widely used. India is the world's largest source of goat skins, and goats are also used there for religious sacrifice, and their hair for coarse blankets.

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(1) Fitch & Baker, Geography of the World's Agriculture.

87

The Angora goat is a native of Asia Minor, and yields a long, white, lustrous wool, or hair, called mohair. The highest quality of this mohair is produced in Asia Minor even yet, but South Africa now produces a larger quantity. Of the 12,000,000 goats in Cape Colony, nearly all are Angoras, and mohair is the chief agricultural product of portions of the state.(2)

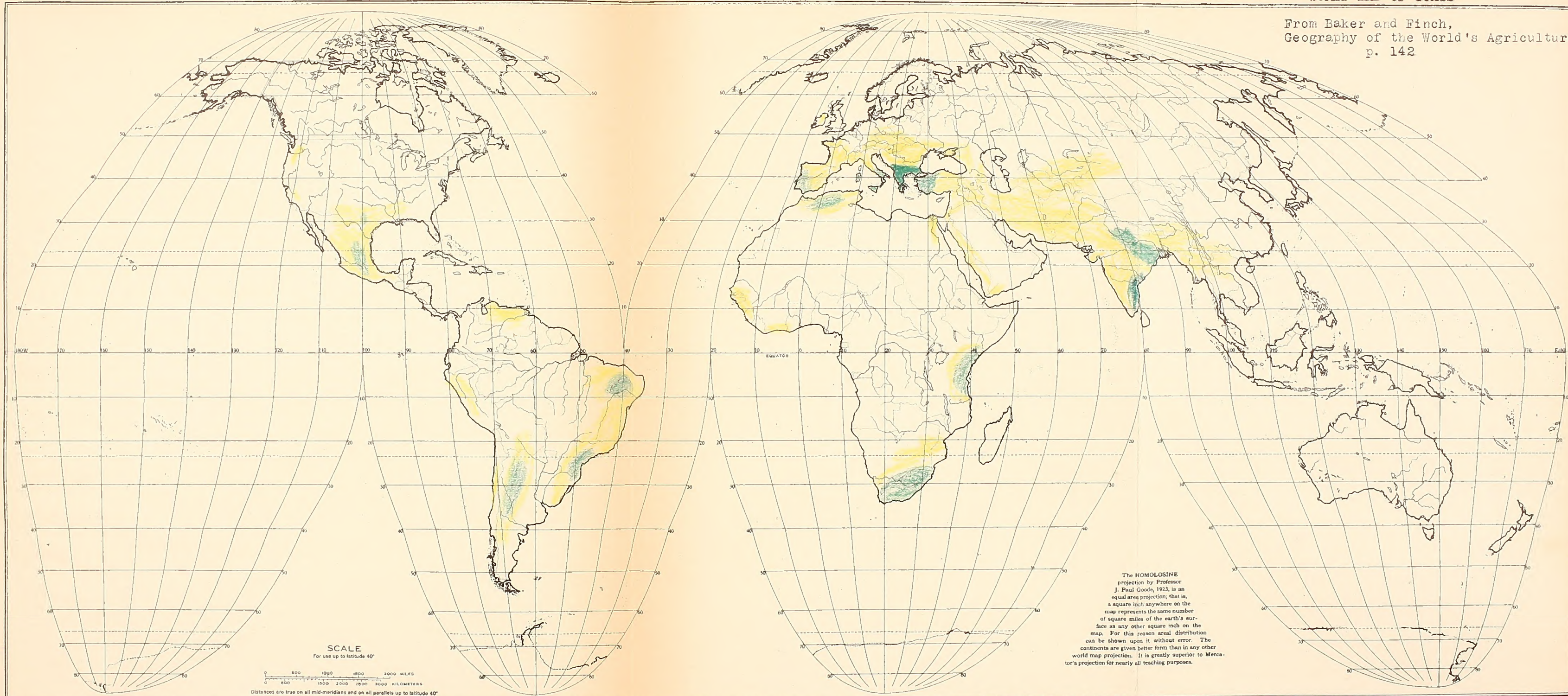
Argentina illustrates best the principle of the regional distribution of cattle, sheep and goats according to the climate. Sheep and cattle are both raised in large numbers on both sides of the Plata River, but the cattle are concentrated in the warm northeastern part of the country where there is abundant summer rainfall; sheep are most plentiful in the eastern part of the country, especially in the south, while goats are raised almost wholly in the warm, semi-arid northwestern part, east of the Andes. Following this principle we can show that most of the occurrence of goat production is in arid regions of sparse vegetation, so unfavorable that the other animals are not profitable. In such conditions the goat replaces the cow as a source of milk, supplies meat, skins and hair, and becomes the mainstay and support of the poverty-stricken inhabitants.

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The HOMOLOGOSINE projection by Professor J. Paul Goode, 1923, is an equal area projection; that is, a square inch anywhere on the map represents the same number of square miles of the earth's surface as any other square inch on the map. For this reason areal distribution can be shown upon it without error. The continents are given better form than in any other world map projection. It is greatly superior to Mercator's projection for nearly all teaching purposes.

THE DISTRIBUTION OF REINDEER

The horse is the most desirable animal for transportation, where it can be used, but it is also one of the most specialized of animals, and if taken out of its optimum must be protected and fed by man. Where the necessary feed is not available it must be imported, a necessity which prevents many peoples from owning horses. Where horses are not practical substitutes are often found. Toward the north a region is found where no vegetation adequate for horses grows. In some of this north country the more wealthy can own horses, but the average person cannot indulge in such luxury. Even for the wealthy, however, horses are not really satisfactory, for the long winter is accompanied by snows which are too deep for the horse to travel through, and in the summer there are too many swamps and bogs in which the horse wallows and sinks.

These northern tundras have evolved an animal in nature adapted to the conditions, and able to survive their winter snows and summer peat bogs.(1) This animal is the reindeer. It seems to have been domesticated from Neolithic times to the present.(2) Its only winter food is the moss and lichens of the tundra. In the winter its sharp hoofs help it to dig through the snow cover to reach its food. In the summer it

(1) Vidal de la Blache, Principles of Human Geography.
Page 360.

(2) C.A.Ellwood, Cultural Evolution. Page 125.

THE DISTRIBUTION OF HORSES

The horse is the most desirable animal for transportation where it can be used, but it is also one of the most expensive of animals, and it takes out of its optimum what is protected and fed by man. Where the necessary feed is not available it must be imported, a necessity which prevents many people from owning horses. Where horses are not used, substitutes are often found. Toward the north a region is found where no vegetation adequate for horses grows. In most of this north country the more wealthy can own horses, but the average person cannot indulge in such luxury. Even for the wealthy, however, horses are not really satisfactory for the long winter is accompanied by snow which are too deep for the horse to travel through, and in the summer there are too many swamps and bogs in which the horse will not walk.

These northern conditions have evolved an animal in horses adapted to the conditions, and able to survive their winter snow and summer bog. (1) This animal is the reindeer. It seems to have been domesticated from Neolithic times to the present. (2) Its only winter food is the moss and lichen of the tundra. In the winter its sharp hoofs help it to dig through the snow cover to reach its food. In the summer it

(1) Vidal de la Blache, *Principles of Human Geography*.
Page 200.

(2) C.A. Whitcomb, *Collected Evolution*. Page 125.

eats the shoots of the birch and willow. Thus it thrives, and grows fat in a land where most animals would starve.

The peoples that were pushed into the northland, or that migrated there for one reason or another, soon came to depend on the reindeer for much of their living. The Laplanders, in particular, use it as a substitute for horse, cow, sheep and goat. Without the reindeer the Laplander could not exist in those northern regions. The domesticated reindeer is used for food, clothing, house, furniture, implements, and transportation. Its milk and flesh supply food, and its marrow and tongue are considered choice delicacies. Its blood mixed with the contents of the stomach is made into a favorite dish called in Siberia "manyalla"; its intestines are cleaned, filled with tallow, and eaten as a sausage; its skin is made into clothes, bedding, tent-covers, reindeer harness, ropes, cords and fish lines; the hard skin of the forelegs makes an excellent covering for snow shoes. (3) Under favorable conditions a swift reindeer can traverse 150 miles in a day, and a speed of 100 miles a day is often made. It can carry a small man on its back, or pull a load of 300 pounds. It supplies only about a cupfull of milk at a milking, but this is very thick and rich. From it the Lapps manufacture butter and cheese. Such is the animal that makes possible man's existence in the far north.

(3) Sheldon Jackson, The Introduction of Domesticated Reindeer into Alaska. (1891) Page 6.

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(2) Sheldon Jackson, The Introduction of Domesticated

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The reindeer was domesticated by all the northern tribes from Lapland to Bering Strait, but the Eskimo of the New World never domesticated the reindeer. The Chukchi, an Eastern Siberian tribe, owned large herds of domesticated reindeer, while the members of the same tribe living in Alaska, lived only by hunting and fishing. They were familiar with the fact of the domestication of the Siberian reindeer, for they went back and forth across the Bering Strait to visit their kin, but their boats were too small to carry reindeer. There were American caribou in large numbers in Alaska, which the Eskimo hunted but did not domesticate. These caribou are closely related to the reindeer, but do not seem to have been adapted for domestication.(4)

About 1890 the Eskimo tribes of Alaska were faced with starvation because of the encroachment of the white man in killing off their food supply which consisted of whales, walrus, seals, fish and caribou. Any of these animals could have maintained themselves against the primitive methods of the native hunters, but the rifles and other rapid and business-like means of slaughter used by the whites, were quickly making it impossible for the natives to get food. The United States government then took up the cause of the Eskimo, and

(4) Encyclopedia Brittanica, Reindeer.

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introduced reindeer from Siberia to Alaska, taught the Alaskans the methods of caring for and raising these animals, and so elevated the Eskimo from the level of barbarism to the pastoral stage, gave them a reliable food supply, and a valuable occupation. This is probably the only case in history where wider distribution of domestic animals was achieved because of beneficence.

The plan has proved so successful and the animals have been such a God-send to the peoples of the Arctic, that the number of reindeer has increased and their distribution widened to include Greenland, Labrador, and in fact, most of the northern lands which are possible of habitation.

(1) Vidal de la Blache, *Principles of Human Geography*, Page 240.

(2) Huntington & Williams, *Eastman Geography*, Page 100.

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THE DISTRIBUTION OF THE ELEPHANT

The substitute for the horse in the rain forest regions is the elephant. "This animal with its superb massive bulk is a war-machine or the luxurious vehicle of a rajah, rather than a domestic servant,"(1) for its size is so very much more than is needed for the usual purposes of a man that it is not efficient, or convenient. The ideal domestic animal is, as we have already seen, about the size of the horse, which is just the right size to easily carry a man without waste effort, and is easily handled and cared for. Larger animals do not pay, but are like hiring a man to do a boy's work.(2) The elephant, furthermore, cannot work long hours, but usually starts at five o'clock in the morning and stops at eleven o'clock. It has not the hard hoofs usually required in domestic animals, it is seldom raised in captivity, and matures very slowly. For these reasons this animal is not widely used, but is limited to a comparatively small number of localities, where other animals cannot well be used to perform the necessary work.

On the other hand it should be said that elephants are very intelligent, and can consequently do work which other animals cannot do. They are so strong that in the short hours

(1) Vidal de la Blache, Principles of Human Geography.
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(2) Huntington & Williams, Business Geography. Page 185.

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they do work they make up for their lack of endurance. They do not cost much to feed in their native forests, for they can forage for themselves in the afternoon. They live to be very old, 100 to 150 years, so their slowness to mature is not so serious. Although lacking the hard hoof this handicap is offset by the construction of their foot which allows them to traverse bogs and soft land without becoming mired, for they can spread their toes to prevent their sinking too deeply, and then by contracting them again, can pull their foot out easily, like a small post in a large hole.

Until recently it was considered that the Indian Elephant was the only one possible to domesticate, and that the African Elephant had a smaller head and brain capacity, and lacked the necessary intelligence and temperament for domestication. This has been absolutely proven to be false, for African Elephants have been successfully tamed by the Belgians and are at present being used for farm purposes in Africa. In fact it seems likely that the elephants that Hannibal took on his expedition against Rome were African elephants, for the Carthaginian coins which have been found have inscribed on them pictures of elephants which have the typically large ears and slope of the forehead of the African Elephant. So perhaps the domestication of these beasts is not such a recent success as it seems at first.

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In the southern provinces of Anglo-Egyptian Sudan, the Ubangi-Sheri Colony of French Equatoria, and in the greater part of the two Uele districts of the Belgian Congo, there is much stunted brush, but the land is not unfit for farming. The tsetse fly, however, abounds, and so horses and cattle cannot live, yet the colonists, missions, cotton and coffee planters, and agricultural tribes need plowing done. An attempt was made by King Leopold to introduce Indian Elephants in 1879, but they could not stand the climate and all died. About 1904 the Belgian government began experiments on domesticating the African Elephant. By 1906 these elephants were working regularly. After 1919 much more rapid progress has been made. Methods for capturing, taming and training them have been perfected, and are now done without cruelty or brutality. In fact it seems to be a case of winning, rather than breaking them. These elephants seem to be as capable of learning as the Indian breed. They are used especially for plowing, and one elephant can plow two and a half acres in two days, even when working the necessarily short day of six hours. This is more than a team of horses could plow on the average in the same time. The elephants are also used for stumping, piling timber, and for transportation in the open country. Two elephants are used to draw a cart of five ton capacity. The maintainance of an elephant in this country is low, for they get all their

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elephant in this country is low, for they eat all their

own food nearby; two men are necessary for each animal; then with harness, chains, food extras, ointment for injuries, and depreciation, the expense totals to about one shilling a day for each animal.(3) In this region plowing can be done with elephants for about one fifteenth the cost of doing it with tractors.

The Indian-Elephant has been used for many years in India, Ceylon, Burma, Siam and surrounding regions for war, transportation of the wealthy, hunting, and piling logs of the dense, valuable woods of the region, of which teakwood is probably the best known. This work of moving and piling logs, these huge beasts do with remarkable precision and intelligence.(4)

It can be readily seen, then, that the elephant fulfills a very valuable need, for under the conditions in which it works, it would be utterly impossible for other animals to exist. At the same time, however, it must also be borne in mind that however well the elephant performs its duties in its chosen environment, it would be equally unable to compete with other animals in doing similar work elsewhere.

(3) Tracy Philipps, Farming with Elephants.

Living Age, April 15, 1928. Page 735.

(4) Hathi In Hobbles, Literary Digest, Dec.12, 1925.

Pages 64 - 71.

THE DISTRIBUTION OF THE CAMEL

The horse has been suggested as a highly specialized animal, but the camel is even more highly specialized. The camel is distinctly a creature of arid regions and is of little practical value elsewhere. Yet in the desert the camel is as valuable to the inhabitants as the reindeer is to the people of the Arctic. It is used for transportation, plowing, milk and hair. It can go without water for several days, can eat the thorny vegetation of the desert, and can carry a heavy load at a fairly good pace. Its docility and ability to follow a trail which has become covered with sand make it the more valuable. Its soft feet allow it to walk on sand without sinking in, yet this very feature makes it impossible for the camel to travel on slippery or rough land, and prevents it from being good for general pulling. This animal is larger than necessary for one man to ride, and can carry two persons without difficulty.

The camel is distributed over the countries of the Sahara, Egypt, Arabia, the arid parts of Central Asia, the deserts of China, and has recently been introduced with good success into the arid parts of Australia. The Bactrian camel, with two humps, is fitted for long journeys, but cannot make much speed. The Dromedary, or racing camel, however, was developed by skillful selection through antiquity. The credit

is due to the Nabataeans who were the professional caravaneers along the ancient route from Babylonia to Egypt. They were able to hold a monopoly of the trade because of their superior breed of camel. In the dry, healthful climate of Nedjed, they could produce fleeter animals, better able to endure thirst. These Dromedaries can go for five to six days without water, and can cover 360 miles in that time. (1)

So highly specialized an animal is closely limited to its natural environment; outside this environment it becomes handicapped by the very features which enabled it to survive the unfavorable conditions. Practically all the camels are now domesticated. (2)

The Llama and Alpaca

In past ages there have been several more types of camels, but at present the only other members of this family are founded isolated in the highlands of the Andes Mountains of South America. They are the Llama, Alpaca, Guanaco and Vicugna. Just how these forms of camels came to be in this far-off land, and no other camels found elsewhere, gives rise to much conjecture and arguments for various theories. These animals, too, are highly specialized, but for high, rugged land rather than for hot deserts.

(1) Vidal de la Blache, Principles of Human Geography.
Page 357.

(2) Alfred Russel Wallace, The Geographical Distribution of Animals, Vol.II. Page 216.

The Llama is domesticated in the Andean plateau, where it is used for transportation. This form of camel, however, is much smaller than the Oriental form, and though very sure-footed and able to travel over rough country, is not able to carry over a hundred pound load. Its endurance, furthermore, is limited, and it can make only about ten to twelve miles a day.(3) It can thrive where a horse or mule cannot, for it requires little food and water, and can go on a handful of corn a day. These animals are very useful for transportation in the Andes, but have never been successfully introduced elsewhere. The Llama was formerly the only beast of burden in the Americas, aside from the dog.

The Guanaco and Vicugna are not domesticated, but are hunted by the natives. The Alpaca is domesticated, or semi-domesticated, but is not used for transport, but kept only for its wool. The geographical distribution of these animals is identical with a species of grass called 'ichu'. This grass grows in the high ridges of the Andes up to the snow line, from the equator to the southern tip of Patagonia, and furnishes the pasturage for these animals.(4)

(3) Vidal de la Blache, Principles of Human Geography.

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(4) A.C.Semple, Influences of Geographic Environment.

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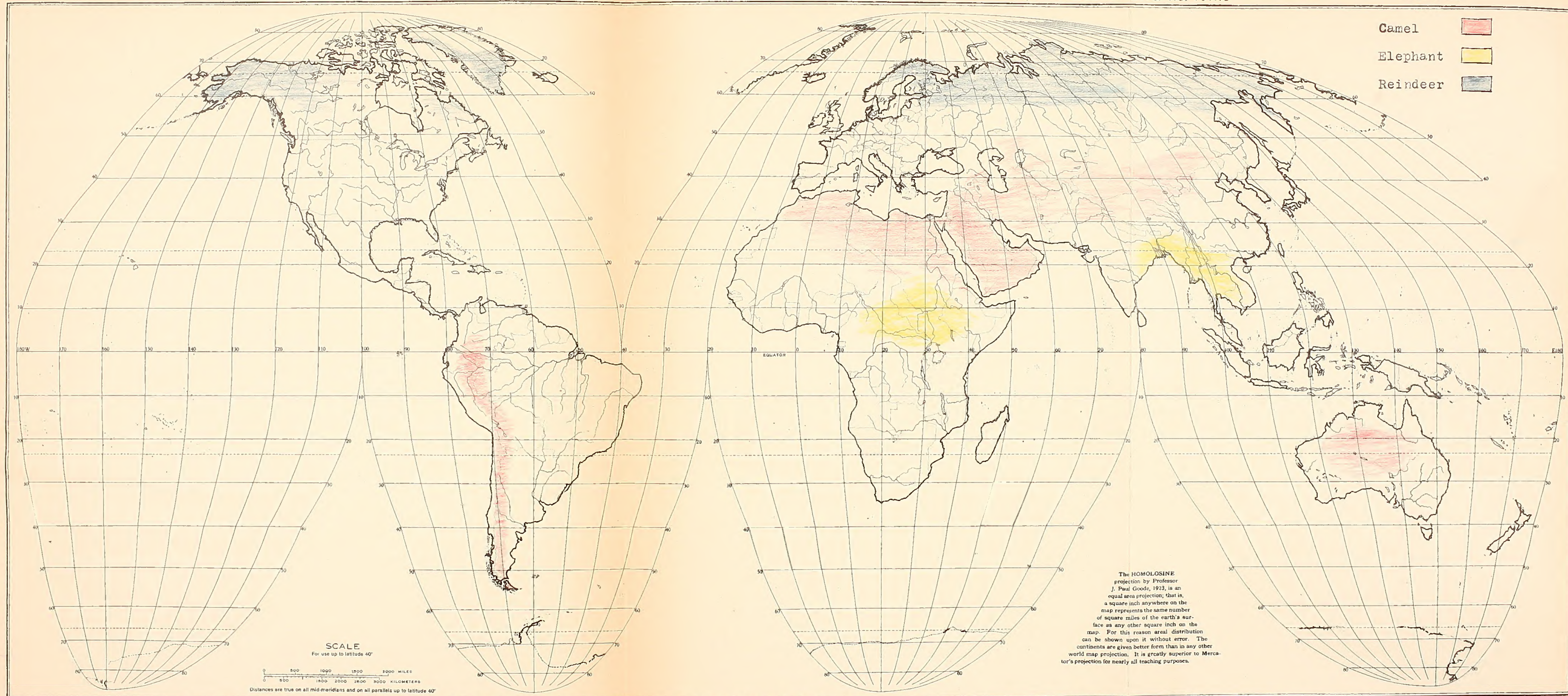
(4) A.C. Sengier, Influences of Geographic Environment.

Page 64.

GOODE'S SERIES OF BASE MAPS AND GRAPHS. THE WORLD ON GOODE'S HOMOLOGINE PROJECTION, INTERRUPTED, FOR THE CONTINENTS. NO. 101HC

REINDEER

- Camel
- Elephant
- Reindeer



The HOMOLOGINE projection by Professor J. Paul Goode, 1923, is an equal area projection; that is, a square inch anywhere on the map represents the same number of square miles of the earth's surface as any other square inch on the map. For this reason areal distribution can be shown upon it without error. The continents are given better form than in any other world map projection. It is greatly superior to Mercator's projection for nearly all teaching purposes.

THE DISTRIBUTION OF SWINE

The modern swine seem to have originated from several species of pigs, which were domesticated in Neolithic times, and were closely enough related to breed together. The result has been an animal which can live in many regions under a variety of conditions, and is easily adapted to the necessities of a new environment. In nature the pig is a forest animal, living on roots, nuts and other concentrated food. It cannot graze in the open prairie, or live on the ordinary grass, and so in domestication is not kept under range conditions like cattle. Yet there are a great number of things which swine will eat, so its distribution is very wide, and is affected more by economic and domestic conditions than by climatic conditions.

The distribution of swine is in a general way somewhat similar to that of men and of cattle, but is determined locally by some rather definite principles. The advantages of the animal are numerous. It breeds freely, grows rapidly, furnishes much meat in comparison with the food consumed. It eats many kinds of food, such as garbage, potatoes, acorns, roots and skimmed milk, all of which most other domestic animals do not use. Although it can live nearly anywhere man does, the map of swine will show that there are great areas in which there are practically none present. Religious prejudices, or the relatively high price, or scarcity of

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food for the animals, may limit its numbers in some localities; and because of the heating qualities of the meat and fat, it is not commonly used in the warmer regions. The odor of pigpens, especially if the animals are fed on garbage, makes their presence undesirable near cities. (1)

In many localities swine are kept for local consumption. This is illustrated by the fact that they are raised in every county in the United States, yet about one half of the total number are found in the corn belt states of Iowa, Missouri, Illinois, Nebraska, Kansas, Indiana and Ohio. (2) Where they are raised in large numbers it is because of the presence of some cheap and abundant food. Thus in the corn belt of the United States, the people "sell what corn they can; what they can't sell they can; what they don't can they feed to the hogs; and what the hogs won't eat they eat themselves." This is probably an exaggeration, for little of the corn is actually sold as such, for hogs are worth several times as much per pound as the corn, and it is cheaper to "sell the corn on the hoof", in the form of hogs or cattle. The increase in the price of corn in Illinois, in the region 150 miles around Chicago and south to the Mississippi, causes

(1) Huntington & Williams, Business Geography.

Page 203.

(2) Baker & Finch, Geography of the World's Agriculture.

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a distinct reduction in the number of hogs raised there, even though that is the greatest center of corn production. The corn in this area averages five cents more per bushel, for it is near the Chicago market, where it is made into glucose, shipped to other parts of the United States, or exported. Besides the corn-fed hogs, many are raised in the dairy districts of the country, and fed on skim milk, together with barley, corn or grains from mill wastes. Such feed is nearly ideal for growing pigs and produces better bacon and hams than the corn does.

In Europe the swine industry centers around the Netherlands, northern Germany and Denmark, but it is by no means limited to these countries. Through northwestern Europe the feed is largely potatoes, barley, and milk by-products, supplemented by corn (maize) imported from the United States, Argentina, South Africa and Russia. On this feed the pigs are more lean and meaty, and grow very rapidly, producing decidedly superior meat. The Irish and Danish bacon brings a premium on the English market, probably because of the feeding of barley meal, skimmed milk and potatoes. In Germany about forty percent of the potato crop is fed to swine. Hungary is about the only European swine-raising country to produce much corn. In the Mediterranean countries there is less demand for pork and less supply of feed, but the latter

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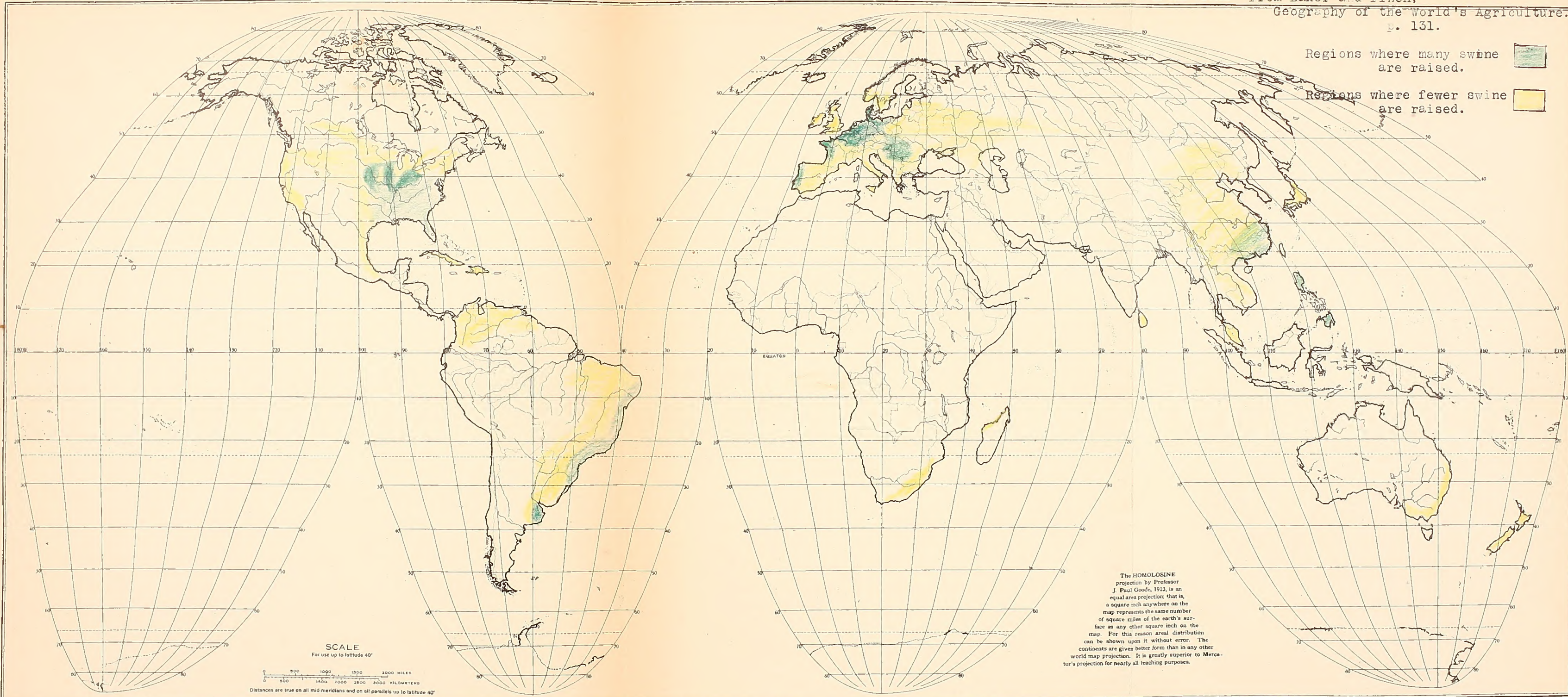
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is made up in part by pasturing swine in the large chestnut, cork and other oak forests, in the autumn.

The use of the meat of swine is forbidden by Mohammed-an, Jewish and Hindu religions, so practically no pigs are found in the countries where these religions predominate. There is a pronounced decrease in the number of swine raised in the boundaries of Poland, a condition which may be explained by the fact that the governmental encouragement which the other European countries received has been lacking, and that there is a large Jewish population, due to previous intolerance toward Jews by the Russian government.

In China many swine are raised, but as the people are frequently on the verge of starvation, there is so little food left which they do not eat, that the pigs must largely support themselves on what they can pick up. In such a poverty-stricken land, the swine tend to compete with the people for food. Any grain or other food which man can eat, can not be spared for the animals; so the proportion of swine to human beings would be low, and their actual importance in the country rather small. All the swine raised would be for local consumption.

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THE DISTRIBUTION OF THE DOG

The early domestication of the dog has already been considered on page two. Since its early origin it has become widely spread over the earth. There must have been several different types of domesticated dogs at a very early time, but the problem of the origin of these has never been satisfactorily settled. Recent careful studies indicate that the domesticated dog is related to the wolves rather than to the groups of canids represented by the coyote, jackal, or fox. The ultimate wolf-like ancestor of the dog is yet to be determined, but present evidence favors the view that it is one of the large circumboreal wolves , but possibly a distinct and smaller species, from which both the large and small breeds of dogs have been derived.(1) The prehistoric dogs of the Old and New Worlds are closely related and are of common ancestry. The people of the New World must have brought their dogs with them, probably from Asia, while at a stage of culture before the domestication of other animals, for there was no other domestic animal which was common to both hemispheres before the arrival of white man. The domestic dog probably originated in Asia, and was carried east and west by the migrating peoples, at an early time, probably late in the Pleistocene Epoch. Thus dogs are

(1) Glover M.Allen, Dogs of the American Aborigines.

Bulletin of M.C.Z., Harvard College, 1920.

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 than to the groups of canids represented by the coyote,
 jackal, or fox. The ultimate wolf-like ancestor of the dog
 is yet to be determined, but present evidence favors the
 view that it is one of the large circumarctic wolves, but
 possibly a distinct and smaller species, from which both the
 large and small breeds of dogs have been derived. (1) The
 prehistoric dogs of the Old and New Worlds are closely re-
 lated and are of common ancestry. The people of the New
 World must have brought their dogs with them, probably from
 Asia, while at a stage of culture before the domestication
 of other animals, for there was no other domestic animal which
 was common to both hemispheres before the arrival of white
 men. The domestic dog probably originated in Asia, and was
 carried east and west by the migrating peoples, at an early
 time, probably late in the Pleistocene Epoch. These dogs are

(1) Oliver M. Allen, Dogs of the American Continent.

191
not necessarily of local origin in the region in which they are found at present.

The dog is an animal which is particularly subject to variation and mutation. Starting as it did with several varieties, many centuries of selection, both conscious, unconscious and natural, would easily result in as much variation as is now found in the dog family.

Dogs are distributed all over the world, wherever man is found. To be sure, some of the varieties and breeds cannot live everywhere. The Newfoundland dog cannot survive in India, nor the short-haired dogs in very cold climates, but nearly every tribe and people have some form of dog. There are, however, comparatively few places where dogs are actively used for work.

The American Indians used dogs a great deal, and depended on them. There were many types of dogs among the Indians, but in general they may be classified into three groups: first, the large wolf-like Eskimo dog of the Arctic; second, the large dog of the Plains Indians, with smaller, erect ears and drooping tail; and third, the Indian dog which was much smaller, the size of a terrier.

The Eskimo dog was distributed in the north from Alaska to Labrador. It is not a tame wolf, and does not even seem to be very closely related to the wolves. It is probably

not necessarily of local origin in the region in which they are found at present.

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The American Indians used dogs a great deal, and based on them. Their were many types of dogs among the Indians, but in general they may be classified into three groups: first, the large wolf-like Indian dog of the Arctic; second, the large dog of the Indian Indians, with smaller erect ears and bushy tail; and third, the Indian dog which was much smaller, the size of a cat.

The Indian dog was distributed in the north from Alaska to Labrador. It is not a tame wolf, and does not even seem to be very closely related to the wolf. It is probably

of the same origin as the Siberian Sledge -dog, which is slightly larger, but otherwise closely similar, and found across northern Asia to Lapland.

The dog of the Plains Indians was slightly smaller, tawney-colored, and distributed from western North America through the Great Plains, northward to British Columbia, and southward to the Mexican boundary. Though appearing strikingly like the coyote, its jaws do not show much relation, and it is doubtful if this breed had much coyote blood. These dogs were of great service to their masters as pack animals, and for the pursuit of bison. They were the only domestic animals the Indians had, and served the purposes of these migrating hunters remarkably well. A travois was formed by fastening two lodge poles together, resting on the dog's shoulders, the heavier ends on the ground. A crosspiece kept them apart, and trailing behind. A leather collar held the travois in position for dragging the goods piled upon it. In this way entire villages moved, the dogs dragging the household effects. (2) After the introduction of the horse in this hemisphere, by the Spaniards, the larger animal replaced dogs for transportation purposes.

The Pueblo Indians had a local breed of the Plains Indian dog, which they sheared and used the hair for making a kind of cloth.

(2) Glover M. Allen, Dogs of the American Aborigines.

Bulletin of M.C.Z., Harvard College, 1920. Page 254.

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The Short-legged dog is distributed among the canoe-using Indians from southern British Columbia to Quebec.

These dogs were formerly among all the forest-living tribes of the North. They are household pets and hunting companions, but are too small for the travois or pannier, to serve as pack animals. They are very active and agile at jumping, and are of great value in hunting beaver. Many of these dogs earn hundreds of dollars in beaver skins for their masters every winter at the present time in the woods of Quebec.

The Eskimo dogs, mixed with various breeds, are being used more and more in the winter for transportation in regions where other forms of travel are not possible. They have made possible the discovery and exploration of much of the Arctic and Antarctic, and the development and exploration of Alaska. In Belgium and Holland dogs are used to a limited extent to deliver milk and vegetables; and in many other places to herd and protect other domestic animals. The rest of the dogs the world over are distributed where man is, and are important for their protective instinct, and comradeship.

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THE DISTRIBUTION OF THE CAT

The cat, we know, has been domesticated since very early times, and seems to have originated with the Egyptians, but although much study has been given the matter, it is not certain from what wild form the domestic cats have sprung. The present wild representatives of this family are extremely savage and difficult to tame, so how did the early people first accomplish the task? Yet our common domestic cats, that have been under man's influence for centuries, often revert to the wild and become untamed hunters; and under proper provocation, the most peaceful tabby cats may become surprisingly violent. There seems to have been two or three wild progenitors of the present cat, with more or less blending to produce our present forms.

The Egyptians domesticated an African wild cat, *Felis ocreata maniculata*, which was later exported in considerable numbers and has become crossed with the European wild cat, *Felis catus*. The long-haired cats appear to have had a distinct ancestry from that of the short-haired variety.

Whatever their ancestry, the principles of their distribution remain much the same. The cats are true carnivora, and natural-born hunters. While under domestication, cats are frequently forced to eat other food, their natural food is meat, and they are remarkably well fitted to maintain their own food supply, if given the opportunity. It is on this natural ability to hunt that their usefulness to man has depended, for otherwise they are very little use to him, other than as pets. They seldom if ever exhibit the protective instincts which the dog has so well developed. In nature the cat's food largely consists

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of rodents and birds, both of which raise havoc in grain-producing countries. Since Egypt was long the granery of the Mediteranean, it is small wonder that it was in this country that the cat was first domesticated. As a protector of grain and other food supplies, the cat's value was so great that it became a household pet and was deified as well.

Today we find cats practically the world over. They vary in appearance, and minor detail, but are essentially much alike. Their wide distribution is due to several factors. They are able to reproduce rapidly, protect themselves from enemies, and find food where other animals would starve. They are useful to man to protect property from destructive rodents, and fulfill the requirements of pets. They are remarkably adaptable, can withstand many climates, and eat a variety of food. To a much less degree they are useful as a source of fur.

of rodents and birds, both of which cause much damage to grain-growing countries. Since Egypt was long the granary of the Mediterranean, it is hardly wonder that it was in this country that the rat was first domesticated. As a protector of grain and other food supplies, the cat's value was at first great. It is a domesticated cat and was called a mouser.

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DISTRIBUTION OF DOMESTIC RODENTS

The Rabbit.

The rabbit, originally a native of Western Europe, has been spread, largely by man, throughout most of the temperate regions. They were native in North America, with some fifty-seven forms present. They were unwittingly introduced into Australia and New Zealand, where there were no natural enemies to keep their numbers in control, and so have multiplied so rapidly that they now constitute a pest.

Under domestication many variations have occurred. The weight of some forms has been quadrupled, different colors and other characteristics have been developed, as well.

Rabbits are used for food in certain regions, especially in parts of Europe. Their fur, dressed and dyed, is the coney of the fur market. It is, in fact, the most satisfactory of the low-priced furs for wearing qualities. Rabbit fur is readily dyed, and for this reason is used in imitation of squirrel, seal, beaver, chinchilla, muskrat, ermine, leopard, and the like. The fur also has excellent felting properties, and is used for making felt hats, and for upholstery purposes.

Although rabbits are still a pest in Australia, they have been put to some use, for that country is the greatest producer of dressed rabbits for meat, which are shipped frozen, and for rabbit skins. Some 70,000,000 of these skins come from Australia each year. New Zealand, Belgium, France, and England also produce many of these animals.

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Although rabbits are still a pest in Australia, they have been put to some use, for that country is the greatest producer of dressed rabbits for meat, which are shipped frozen, and for rabbit skins. Some 20,000,000 of these skins come from Australia each year. New Zealand, Belgium, France, and England also produce many of these animals.

The Guinea Pig.

The guinea pig originated in the northern part of South America, where it was used by the natives as food, and kept for this purpose in a domesticated state. From there it has spread to other regions, but has never become either widely distributed, or of great importance.

At present it is used as food, to some extent, and is said to be delicious eating, although its somewhat rat-like appearance has caused some prejudice. Some are raised for pets, for which the animal is well adapted, since it requires little care and is usually a gentle, friendly little animal. Probably its most important use at present is for scientific purposes. The rapidity with which these animals reproduce, their susceptibility to some diseases of man, and the ease with which they may be kept, make them exceptionally desirable for such purposes.

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SUMMARY

The attempt in this paper has been to bring out and explain the factors which have led to the present distribution of domestic mammals, rather than to especially endeavor to describe the present distribution. Where such description has been included it has been chiefly to bring out the principles which cause the distribution.

The domestication of animals began probably in Neolithic times with the dog, and then spread to the other animals. Such animals were of great value in preventing famines and in aiding other advances in civilization. Under domestication the different groups came in time to lose certain of their characteristics and acquire others, and such change has culminated in our present forms of domestic animals.

If no animals are present in nature in a region, the people must either entirely do without domestic animals, domesticate unsatisfactory animals, or introduce more satisfactory forms from other regions.

The distribution of animals by man has been very widespread, but has been greatly influenced by physiography, climate and vegetation, as well as by the use to which the animals were put, and the means of travel of the people who were migrating.

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The domestication of animals began probably in Mesolithic times with the dog, and then spread to the other animals. Such animals were of great value in providing food and in aiding other advances in civilization. Under domestication the different groups came to have certain of their characteristics and adaptive organs, and such change has continued in our present forms of domestic animals.

If no animals are present in nature in a region, the people must either entirely do without domestic animals, domesticate unsatisfactory animals, or introduce more satisfactory forms from other regions.

The distribution of animals by man has been very widespread, but has been greatly influenced by geography, climate and vegetation, as well as by the use to which the animals were put, and the means of travel of the people who were migrating.

Such factors as the value of animals for food, for transportation, or as a source of raw material for manufacture, are important. The distribution of all domestic animals, however, is closely determined by the distribution of man. Political policies have encouraged colonization and migration of people, who have taken to the new lands their ideas and animals, thus resulting in a further distribution of the animals.

In choosing domestic animals for a region it is essential that the animal be able to thrive in that particular climate. The most valuable breeds of animals would naturally be chosen, but in such places as they are not able to live, other less valuable animals are utilized as substitutes. As a general principle, that form of animal which is most profitable for the given conditions comes to dominate.

Sheep thrive best on the Mediterranean type of climate, where it is moderately dry. Because of the value of sheep in supplying wool and meat, other breeds have been developed which can thrive under a variety of conditions, and specialize in other phases of the industry. Sheep are raised in the largest numbers in the great plains, where conditions are too arid for cattle. Some sheep raising is carried on in regions of intensive agriculture.

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The horse is the most valuable animal for transportation, but is limited in its distribution, because of its inability to thrive under adverse conditions. It requires the best of food, and not too great heat. Where conditions are not favorable for the horse, the mule or ass is usually employed as the next best substitute. This would be especially true in regions of rugged topography, heat, aridity, or poverty of the people. The goat bears much the same relation to the sheep as the mule bears to the horse, for the goat is raised where the land is too rough or arid for successful sheep-raising. It is also used for milk production in place of the cow, in arid regions, a fact which adds greatly to its distribution.

Cattle are used for three purposes, beef, milk, and transportation. Since they are very valuable for each purpose, and are not usually used for all three in the same locality, their distribution is very wide. Furthermore, as there are several varieties of cattle fitted for different conditions, they are enabled to live in a wide range of climates. Dairying is the most profitable of the cattle-raising industries, and is carried on under intensive methods. It is limited to regions of moderately cool, moist climate, and abundant fodder, except as influenced by the local demand of cities.

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111

In the regions where the three most profitable animals, horses, cattle and sheep cannot be raised, others are substituted. In the far north the substitute is the dog or the reindeer. The latter is the more valuable, for it can live off the tundra moss, and supplies the natives with many of their needs. In the rain forests the elephant has been pressed into service, and under the conditions does very well as a beast of burden and draft animal. In the deserts the camel makes transportation possible. So man's needs for domestic animals are met in the most effective way, by the most effective form of animal that can thrive in the given region, with certain exceptions, due to social custom, religion, superstition, taboo and prejudice.

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